Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy

Overview and Summary

Report Number 21-07 | January 2021

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

NORMANDEAU ASSOCIATES ENVIRONMENTAL CONSULTANTS

APEM

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NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

Our Vision:

New York is a global climate leader building a healthier future with thriving communities; homes and businesses powered by clean energy; and economic opportunities accessible to all New Yorkers.

Our Mission:

Advance clean energy innovation and investments to combat climate change, improving the health, resiliency, and prosperity of New Yorkers and delivering benefits equitably to all.

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Overview and Summary

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Notice

Abstract

NYSERDA tasked Normandeau Associates and their teaming partner APEM Ltd. to collect aerial digital imagery over the New York Offshore Planning Area during 12 surveys spaced seasonally over three years between 2016 and 2019. Imagery was captured at a resolution of 1.5 cm at the sea surface and provides information on spatial and temporal abundances of birds, marine mammals, turtles, rays, sharks, large bony fishes and fish shoals. The Summary report provides a broad overview of spatial and temporal patterns of abundance for birds, marine mammals, turtles, rays, and sharks. Spatial patterns were analyzed within distance from shore and water depth zones, and reference the proposed Call Areas within the surveyed planning area which had been identified by BOEM at the time of writing. Seasonal density comparisons highlight the differences between zones for each species group. With the exception of turtles, densities were generally lower in the zone containing the identified BOEM Call Areas. Full Summary and Final Reports can also be found on remote.normandeau.com https://remote.normandeau.com/aer_docs.php?pj=6

Keywords

Marine mammals, Birds, Turtles, Rays, Sharks, Aerial Digital Surveys, NYSERDA, Normandeau, APEM, Call Area, Density, Distribution, Abundance, Marine Wildlife

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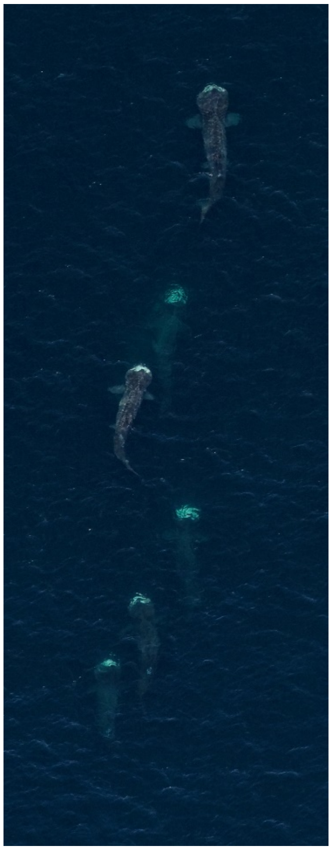
1 Introduction and Background



In support of New York State's commitment to incorporating offshore wind into its energy portfolio, the New York State Energy Research and Development Authority (NYSERDA) embarked on a multiyear ultrahigh, resolution aerial digital survey of marine resources in a 43,745.20 kilometers squared (km^2/12,754.06 mi^2) offshore planning area (OPA) in 2016. The OPA encompasses the waters of the New York Bight from Long Island southeast to the continental shelf break. After approximately 36,238 nautical miles of flights above the potential rotor swept area conducted over 12 seasonal surveys (see Table 1 for timing), the 3.6 million images collected have provided NYSERDA with a stunning baseline of information about the avian and marine wildlife in the OPA.

One year after mobilizing the first aerial digital surveys, call areas for wind energy were identified within the New York State Area for Consideration for the Potential Locating of Offshore Wind Energy Areas ("Area for Consideration") as described in the New York State Offshore Wind Master Plan (NYSERDA 2017). The document fulfilled one of the key goals of the New York State Offshore Wind Master Plan and identified a broad area of the OPA with generally lower densities of marine biota, as well as some areas for consideration which were generated using a combined assessment of multi-stakeholder interests in addition to available information of biological activity. A further two years of seasonal aerial digital surveys have since been completed. This report summarizes the results of the 12-aerial digital surveys conducted on behalf of NYSERDA during summer 2016 through spring 2019 and provides an overview of how the empirical data compare with the modeled distribution and density information presented in NYSERDA (2017). This aerial digital summary supports a larger five-volume report that describes in detail the methods used to collect and analyze the data gathered during these surveys and provides information on temporal and distribution patterns for each taxon. Whereas this summary reports general patterns of distributions and densities, greater resolution of temporal patterns of activity are available in the relevant volumes of the final report.

Results of the high-resolution aerial digital survey reveal a diverse and dynamic biota that varies between seasons but exhibits repeatable spatial distributions. These data provide important support for the development of offshore wind in the OPA, confirming that the proposed call areas for wind energy identified in NYSERDA's Area for Consideration for the Potential Locating of Offshore Wind Energy Areas (NYSERDA 2017) are in areas with lower abundances of marine and avian resources.

For each survey, approximately 300,000 images were collected within the OPA using a transect design. Striking among the results is the fact that 98% of the images contained no target species groups, vessels, or structures. Despite the seemingly low numbers of images capturing biota, the survey collected images of 205,277 animals representing the following:

- Species of birds: 76
- Species of sharks: 15
- Species of dolphins: 9
- Species of whales: 9
- Species of sea turtles: 4
- Species of rays: 6
- Species of seals: 3

Table 1. Starting and Ending Dates and Number of Days to Complete each Survey

Season	Reference Month	Date Started	Date Completed	# Days to Complete
Year 1				
Summer 2016	Aug 2016	26 Jul 2016	9 Aug 2016	13
Fall 2016	Nov 2016	5 Nov 2016	27 Nov 2016	10
Winter 2016–2017	Mar 2017	6 Mar 2017	3 Apr 2017	10
Spring 2017	May 2017	4 May 2017	21 May 2017	9
Year 2				
Summer 2017	Aug 2017	6 Aug 2017	21 Aug 2017	8
Fall 2017	Nov 2017	9 Nov 2017	27 Nov 2017	8
Winter 2017–2018	Feb 2018	18 Feb 2018	1 Mar 2018	6
Spring 2018	May 2018	21 Apr 2018	26 Apr 2018	5
Year 3				
Summer 2018	Aug 2018	29 Jul 2018	16 Aug 2018	8
Fall 2018	Nov 2018	11 Nov 2018	7 Dec 2018	12
Winter 2018-2019	Mar 2019	3 Feb 2019	17 Feb 2019	8
Spring 2019	May 2019	27 Apr 2019	7 May 2019	5

Some seasonal patterns of biological activity were evident and these differed among species groups. In the summer surveys, ray encounters were the most frequent, with birds, marine mammals, sharks, and turtles as the next most frequently encountered groups. During the fall surveys bird encounters were the most frequent, followed by marine mammals. The winter surveys were also dominated by birds followed by marine mammals. In the spring surveys, birds still mostly dominated the sample, and there was a higher proportion of marine mammals, but the spring 2018 survey was quite different, with sharks, mostly spurdogs, representing most of the sample followed by birds.

Bird species composition and abundance varied throughout the year and between years, highlighting not only the seasonal nature of bird activity, but also the interannual variation that can be expected. The summer surveys were dominated by storm-petrels and shearwaters. The fall 2016 survey was dominated by gulls and gannets, the fall 2017 survey by phalaropes and gulls, and the fall 2018 survey by gulls and phalaropes. Winter 2016–2017 was dominated by auks, gulls and gannets, and winter 2017–2018 by shorebirds and gulls, and winter 2018–2019 by gulls and ducks. Spring 2017 was dominated by *Sterna* terns and gulls, spring 2018 was dominated by phalaropes and ducks, and spring 2019 by gulls and storm-petrels.

Turtles were most frequently observed in the summer surveys with 97% of the observations occurring during this season. Loggerhead turtles were the most frequently found representing 74% of the total observations.

Of marine mammals, seals were difficult to identify to the species level with 13% identified to species. Gray, harp, and harbor seals were identified. Dolphins were the most abundant of the marine mammals consisting of 97% of the observations followed by 1% whales and 1% seals; unidentified mammals consisted of 1.5% of the total mammal observations and based on size, these animals were dolphins or seals. Dolphins were abundant in all seasons, particularly in spring and summer surveys. Except for unidentified dolphins, common dolphin was the most abundant species in all but one seasonal survey; the summer 2016 survey had more Risso’s dolphin encounters. Fin whales were the most abundant whale species during the summer, fall, and winter 2017–2018 surveys, while common minke whales were the most abundant species during the winter 2016–2017 and spring surveys. Humpback whales had the same relative abundance as common minke whales in spring 2017 and 2019 but were outnumbered by minke and sei whales in the spring 2018 survey. North Atlantic right whales were present in the winter 2016–2017 and spring 2017 surveys. Sperm whales were observed in the summer 2017, summer 2018, fall 2016, fall 2018, and winter 2018–2019 surveys.

Rays mostly occurred during the summer and fall surveys with one ray observed in the spring 2019, and >99% of observations occurred in the summer surveys. Cownose, bullnose, and cownose/bullnose rays were the most abundant with 85% of the total observations. These surveys were the first to report giant manta rays at this northerly latitude, thus expanding their known range.

The majority (88%) of shark observations occurred during the spring 2018 survey. The remaining shark observations were mainly in the summer surveys across the OPA. Only blue sharks, basking sharks, white shark, scalloped hammerhead, smooth hammerhead, and tiger sharks were observed along with other unidentified species during the fall surveys. In the winter surveys, only basking shark, white shark, blue shark and spurdog were found.

Sixteen positively identified threatened and/or endangered species were recorded within the OPA during the 12 surveys not including species groups that may include listed species. Our categorization of threatened and endangered species was conservative and included species groups: "*Sterna* tern" possibly representing roseate tern, "hammerhead shark (unid.)" possibly representing scalloped hammerhead, and "turtle species unknown" possibly representing all endangered turtles (Table 2). More than 68% of listed species observations occurred in summer surveys and 30% occurred in spring surveys. Both seasonal surveys were dominated by numbers of *Sterna* terns and loggerhead turtles. Roseate terns identified to species comprised only 0.7% of observations (n=33).

Table 2. ESA and State Listed Species Found during the Summer 2016 through Spring 2019 Surveys in the OPA

Subtype	Species	Scientific Name
Shorebird	Piping Plover	*Charadrius melodus*
Sterna Tern	Roseate Tern	*Sterna dougallii*
Sterna Tern	Sterna Tern—species unknown	*Sterna sp.*
Whale	North Atlantic Right Whale	*Eubalaena glacialis*
Whale	Blue Whale	*Balaenoptera musculus*
Whale	Fin Whale	*Balaenoptera physalus*
Whale	Sei Whale	*Balaenoptera borealis*
Whale	Humpback Whale	*Megaptera novaeangliae*
Whale	Sperm Whale	*Physeter macrocephalus*
Turtle	Leatherback Turtle	*Dermochelys coriacea*
Turtle	Loggerhead Turtle	*Caretta caretta*
Turtle	Loggerhead/Kemp's Turtle	-
Turtle	Green Turtle	*Chelonia mydas*
Turtle	Kemp's Ridley Turtle	*Lepidochelys kempii*
Turtle	Turtle—species unknown	-
Shark	Whale Shark	*Rhincodon typus*
Shark	Shortfin Mako	*Isurus oxyrinchus*
Shark	Scalloped Hammerhead	*Sphyrna lewini*
Shark	Hammerhead (unid.)	*Sphyrna sp.*
Ray	Giant Manta Ray	*Manta birostris*
Tuna	Atlantic bluefin tuna	*Thunnus thynnus*

2 Spatial Patterns of Activity

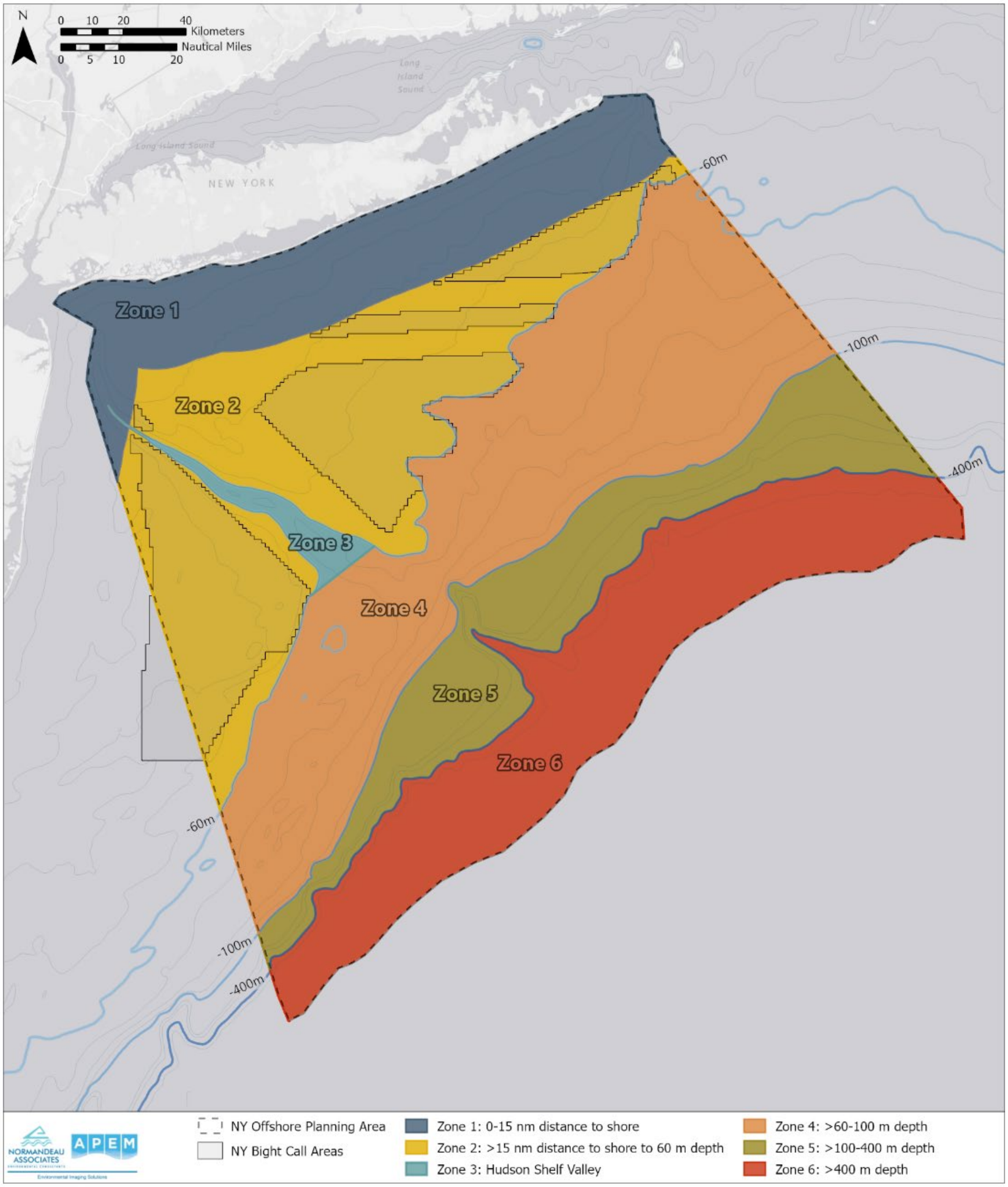
The sections of activity in "Area for Consideration" (NYSERDA 2017) broadly categorized distributions and densities into zones, and the selected Areas for Consideration were all located in an area which, by using a similar process of zoning, defined as zone 2 (Figure 1). Zone 1 is the Coastal Zone, zone 2 the Area for Consideration Zone, zone 3 the Hudson Shelf Valley Zone, zone 4 the Shelf Zone, zone 5 the Shelf Slope Zone and zone 6 the Shelf Break Zone (Figure 1). We reviewed spatial distributions and densities of animals generated by the aerial digital survey data and compared these to the information provided in "Area for Consideration" (NYSERDA 2017). Once an offshore wind farm has begun operating, it has the potential to impact birds, and birds can be grouped based on the potential effects on them by offshore wind farms. Population-sensitive birds are species whose population status is already compromised. Collision-sensitive species are those most apt to fly within the rotor-swept zone. Displacement-sensitive species are those whose reaction to the presence of turbines would be to divert their flight patterns to avoid the wind farm. We reviewed areas of bird species sensitivity to population, collision, and displacement impacts, and overlaid the call areas (see Figure 1) on the resulting sensitivity maps.

Density estimates were calculated for each strip transect determined by dividing the total count of individuals within the strip transect by the strip transect area. On the resulting heat maps, density is scaled to the maximum density across all seasons for each taxon.

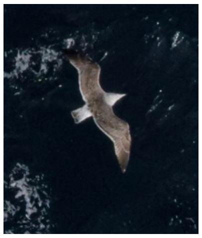
As mentioned, generally, the aerial digital data show very similar patterns of animal density and distributions to those presented in "Area for Consideration" (NYSERDA 2017) and support the selection of the Area for Consideration recommended.

Figure 1. Zones Defined in the Analyses, and Location of the Call Areas

Zone 1 is the Coastal Zone, zone 2, the Area for Consideration Zone, zone 3 the Hudson Shelf Valley Zone, zone 4, the Shelf Zone, zone 5 the Shelf Slope Zone, and zone 6, the Shelf Break Zone.



2.1 Birds



For all birds, which include the 39 species presented in "Area for Consideration" (NYSERDA 2017), the data match the temporally distinct patterns of highest densities occurring in the Coastal Zone 1, the Hudson Shelf Valley Zone 3, and the Shelf Slope Zone 5 (Figure 2, Figure 3). In the spring and fall the Coastal Zone 1 shows higher density, but overall Shelf Slope Zone 5 has the highest density in the winter, and Hudson Shelf Valley Zone 3 has highest densities overall in the fall. Additionally, the bird species population, collision, and displacement sensitivity analyses also show that over the annual cycle Coastal Zone 1, Shelf Zone 4, and Shelf Slope Zone 5 generally show higher bird sensitivities than Area for Consideration Zone 2 (Figure 4, Figure 5, Figure 6).

Figure 2. Heat Map Showing Spatial Distribution for Birds during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

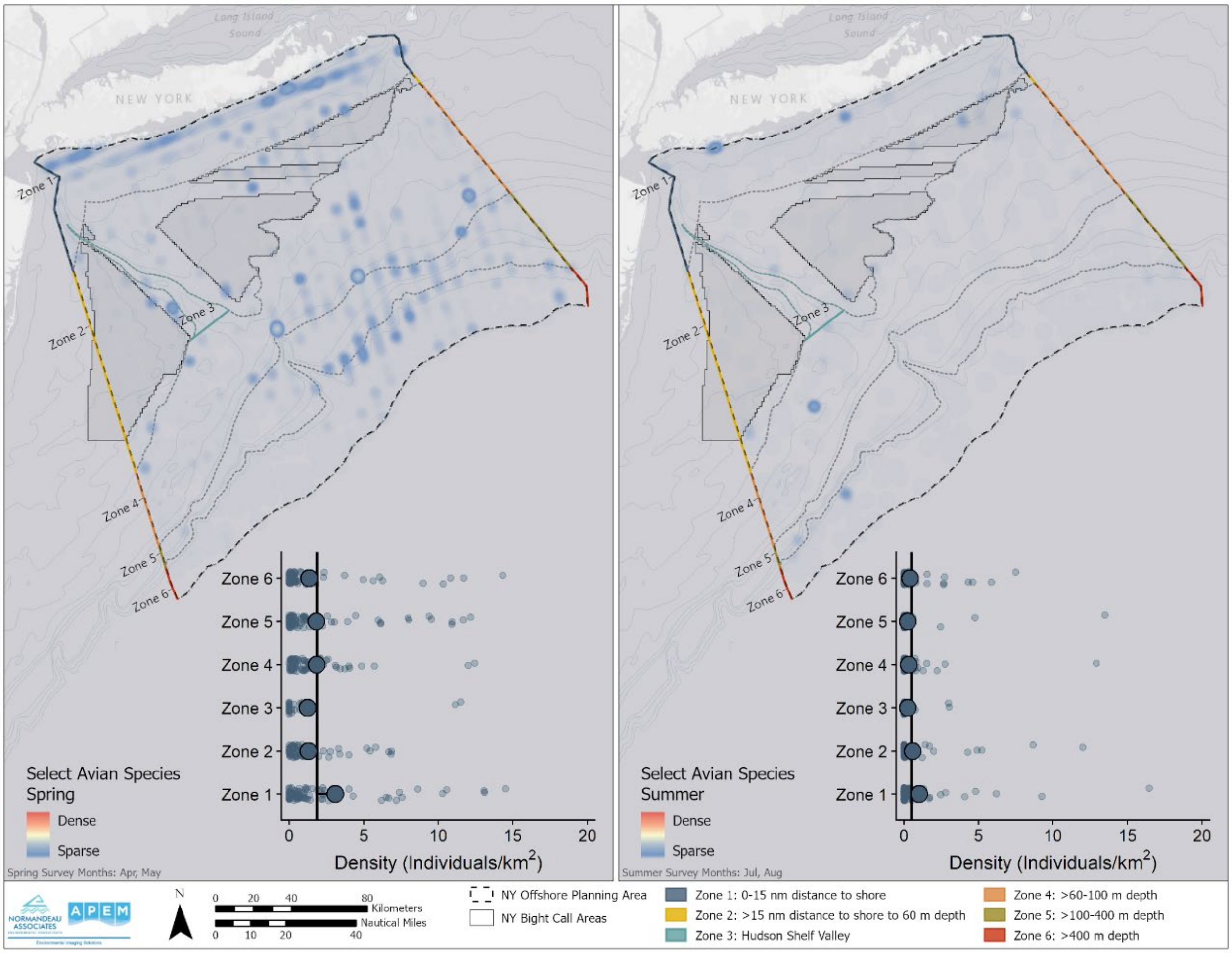


Figure 3. Heat Map showing Spatial Distribution for Birds during Fall and Winter by Zone, and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

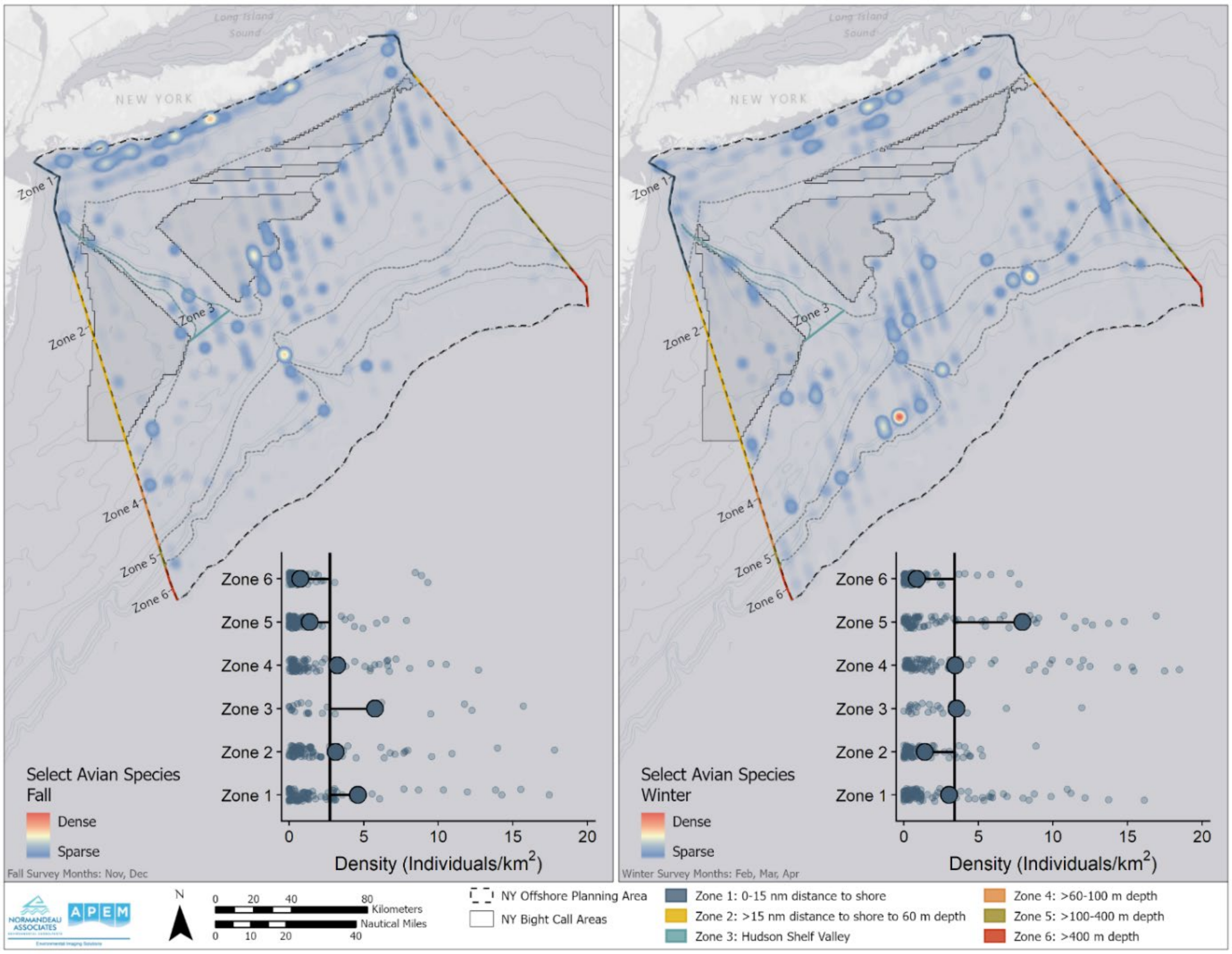


Figure 4. Areas of Population Sensitivity for Bird Species Present in Aerial Digital Surveys in Relation to the Call Areas

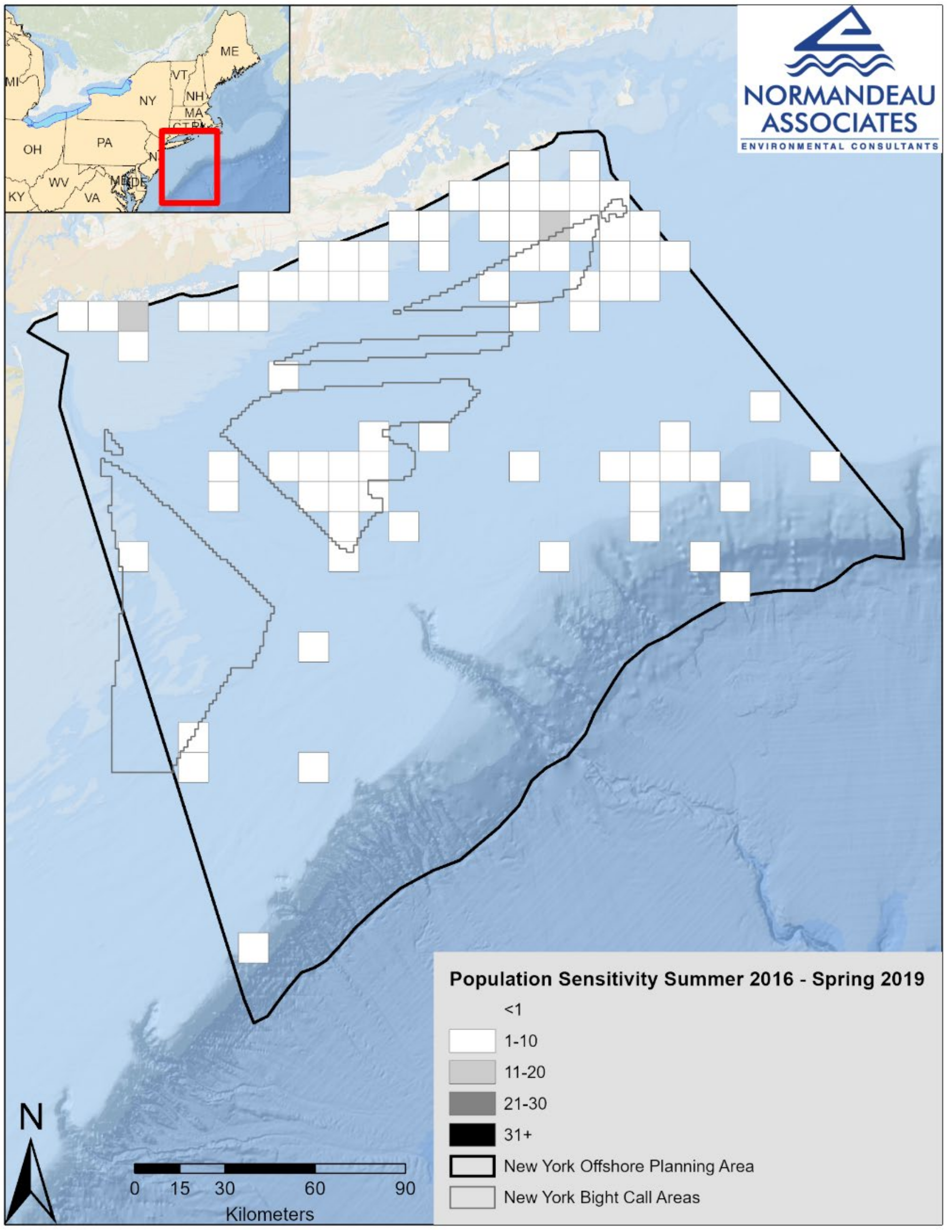


Figure 5. Areas of Collision Sensitivity for Bird Species Present in Aerial Digital Surveys in Relation to the Call Areas

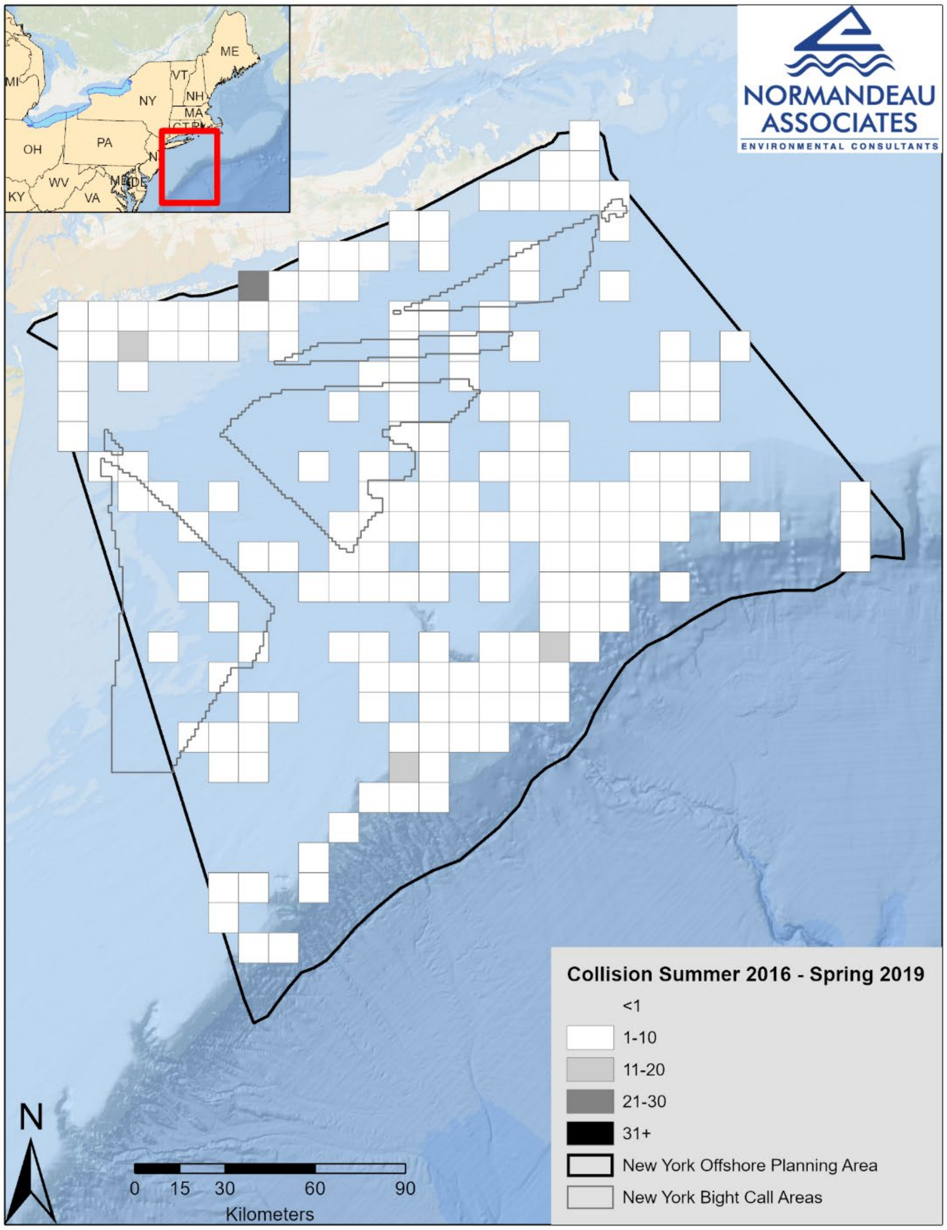
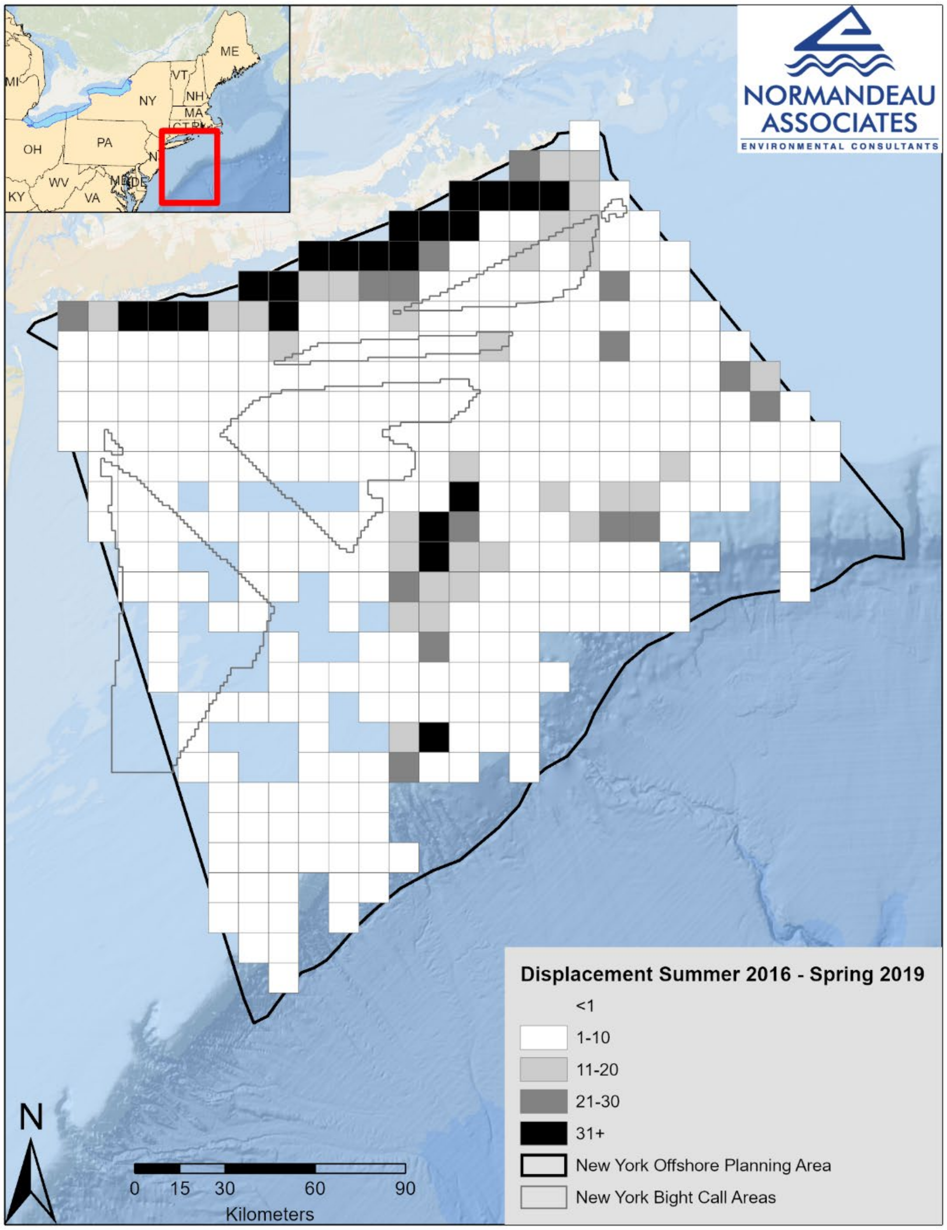


Figure 6. Areas of Displacement Sensitivity for Bird Species Present in Aerial Digital Surveys in Relation to the Call Areas



2.2 Turtles

Turtles show a strong southwest abundance and northwest absence, but across zones the general density of turtles were fairly even except in the summer when turtles were most abundant and located in the Area of Consideration Zone 2 (Figure 7, Figure 8). Aerial digital surveys are the most effective survey platform for detecting turtles, with four times more seen by aerial digital surveys than aerial visual survey methods, and ten times more seen by aerial digital than boat-based methods (Robinson Willmott et al. 2013). In “Area for Consideration” (NYSERDA 2017), turtle densities generally increase from the Coastal Zone 1 out to the Shelf Break Zone 6. Here we see a close association with the 70-meter (m) isobaths keeping most turtles within Area of Consideration Zone 2 (Figure 7).

Figure 7. Heat Map Showing Spatial Distribution for Turtles during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

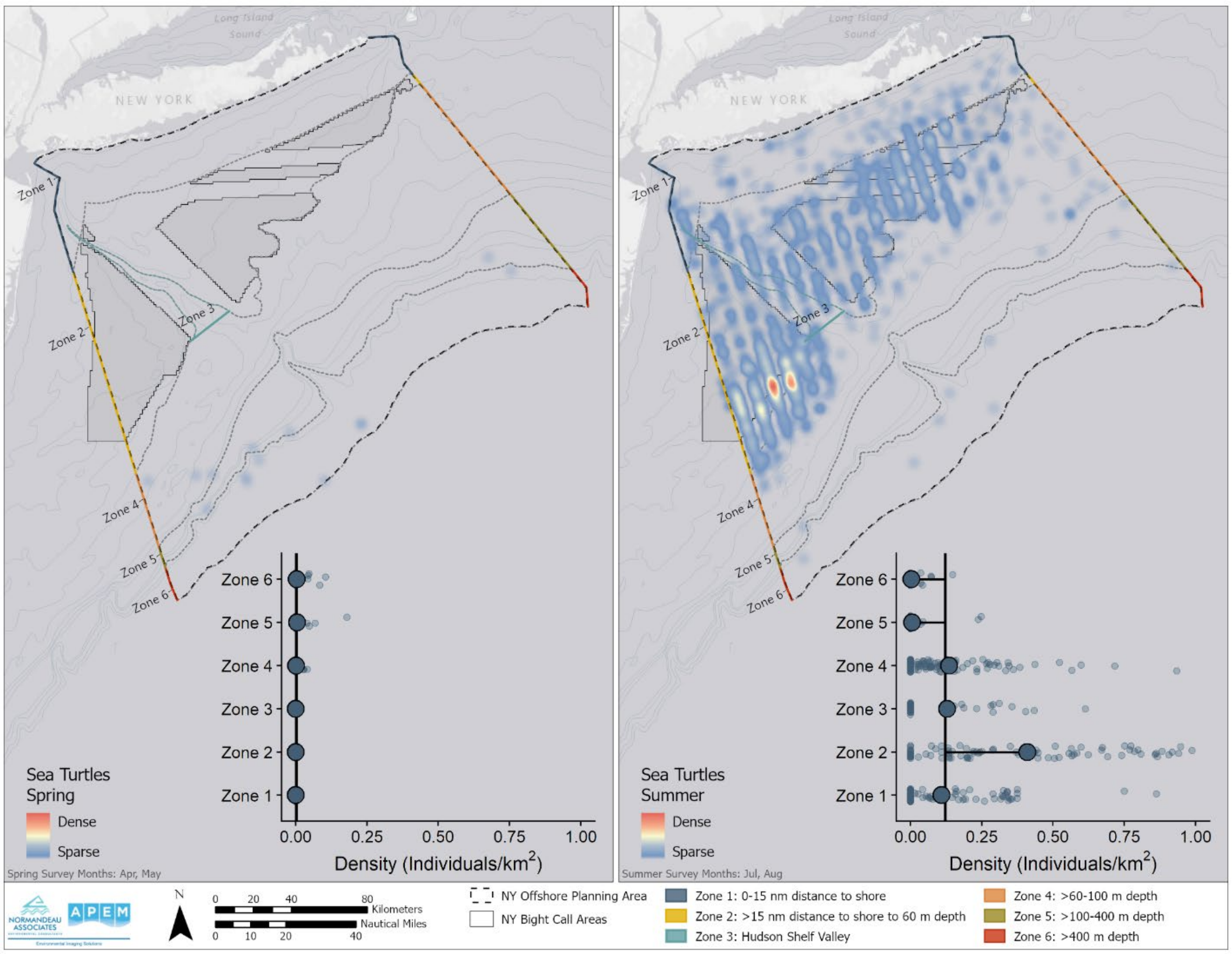
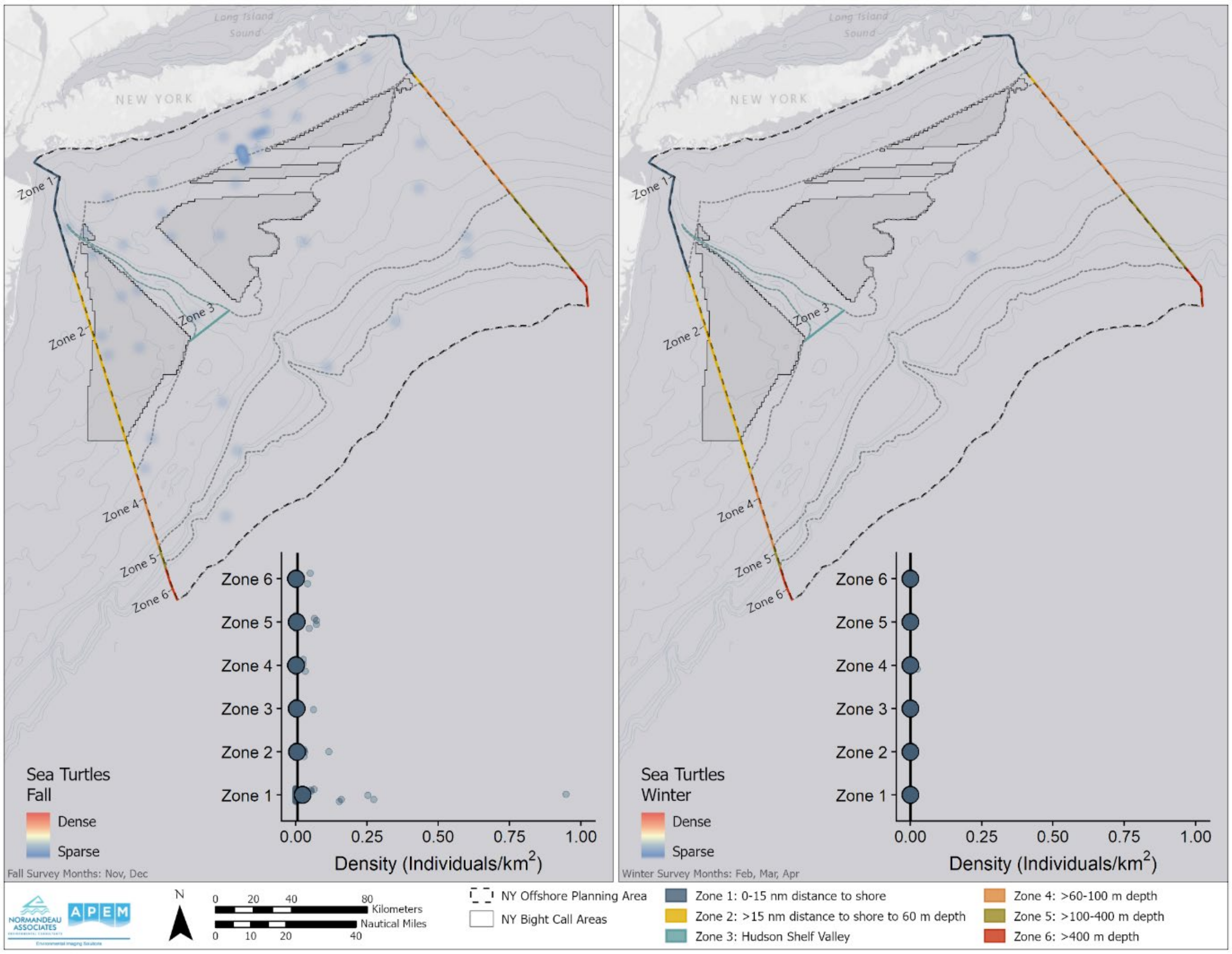
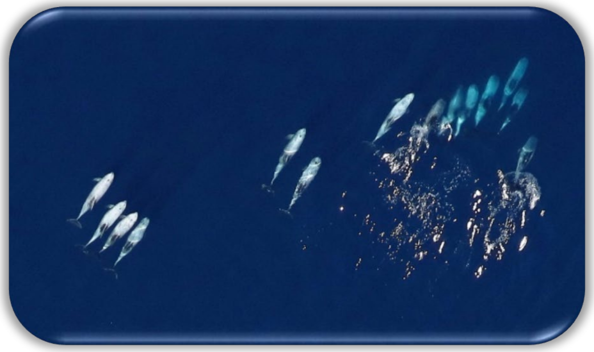


Figure 8. Heat Map Showing Spatial Distribution for Turtles during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



2.3 Marine Mammals (Cetaceans and Pinnipeds)



“Area for Consideration” (NYSERDA 2017) reports mammals by underwater auditory frequency groups (see Table 3) and so we similarly grouped marine mammals into these same groups for ease of comparison. North Atlantic right whale is treated independently under the endangered species section below.

The high-frequency cetacean group includes harbor porpoise, which was the dominant species in this group. Only two dwarf sperm whales and three pygmy sperm whales were reported among the 424 harbor porpoises also represented in this group. High-frequency cetaceans shows low overall abundance in the summer and fall, and higher abundance in Coastal Zone 1 in the spring, and higher abundance in Area for Consideration Zone 2 in the spring and winter (Figure 9, Figure 10).

Figure 9. Heat Map Showing Spatial Distribution for High-Frequency Cetaceans during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

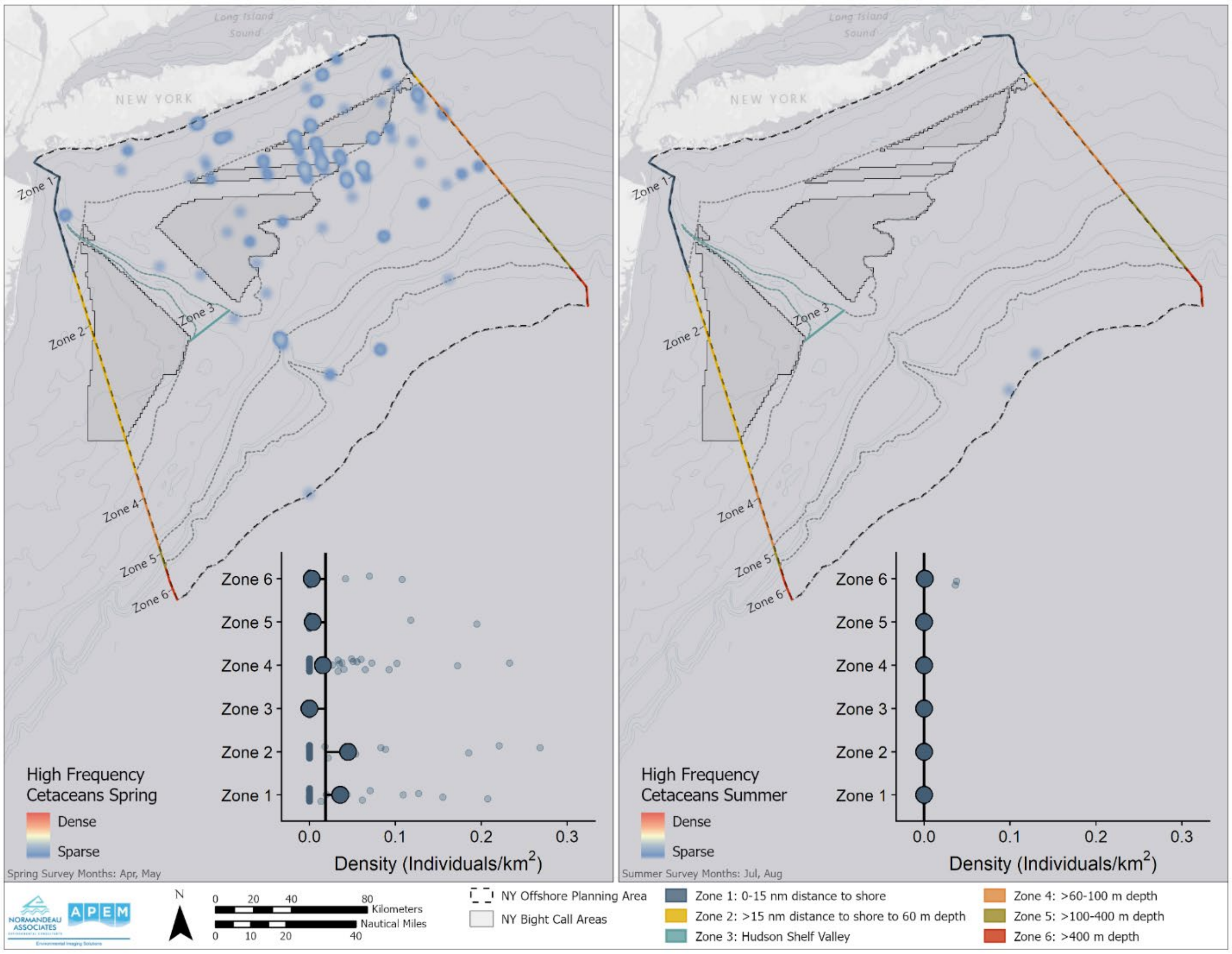
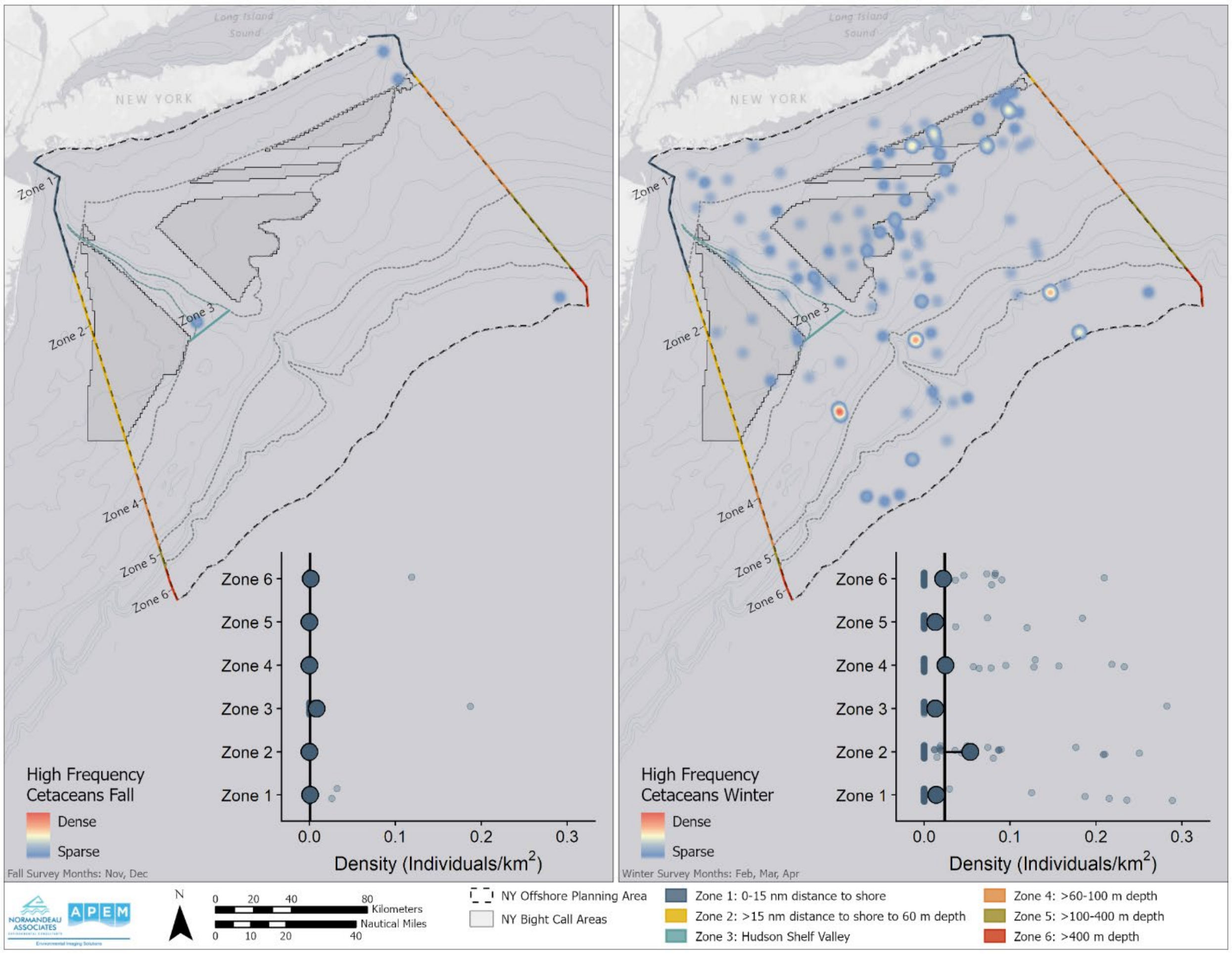


Figure 10. Heat Map Showing Spatial Distribution for High-Frequency Cetaceans during Fall and winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



The mid-frequency cetacean group includes many dolphin species as well as sperm whales. Within this group we have a total of 13 sperm whales, 26 beaked whales, and 10,099 dolphins of nine different species. The density and distribution patterns closely follow "Area for Consideration" (NYSERDA 2017) with highest abundance in zone 5 and zone 6. The aerial digital data is slightly different, showing a higher abundance in the Hudson Shelf Valley Zone 3 in the fall (Figure 11, Figure 12).

Figure 11. Heat Map Showing Spatial Distribution for Mid-Frequency Cetaceans during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

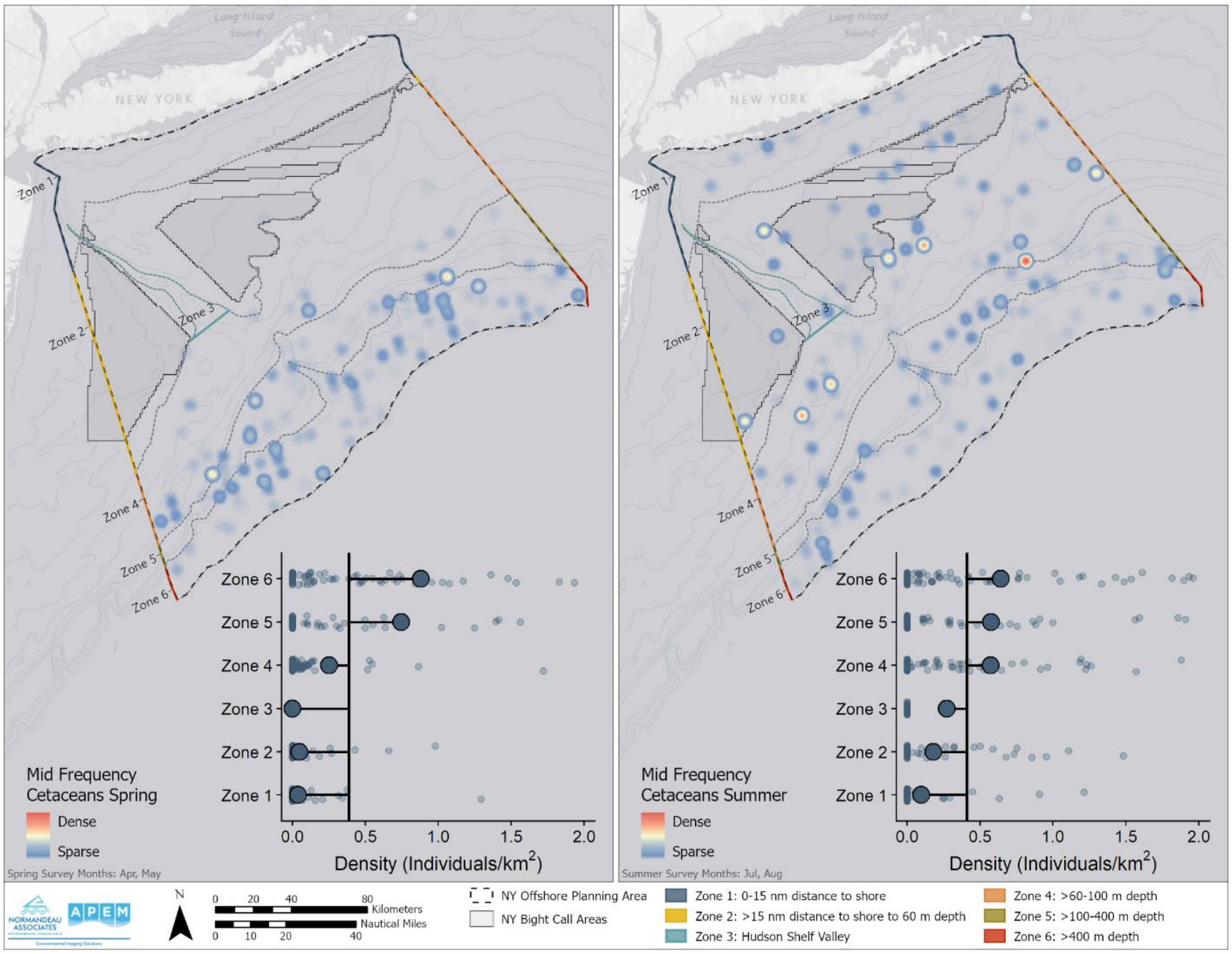
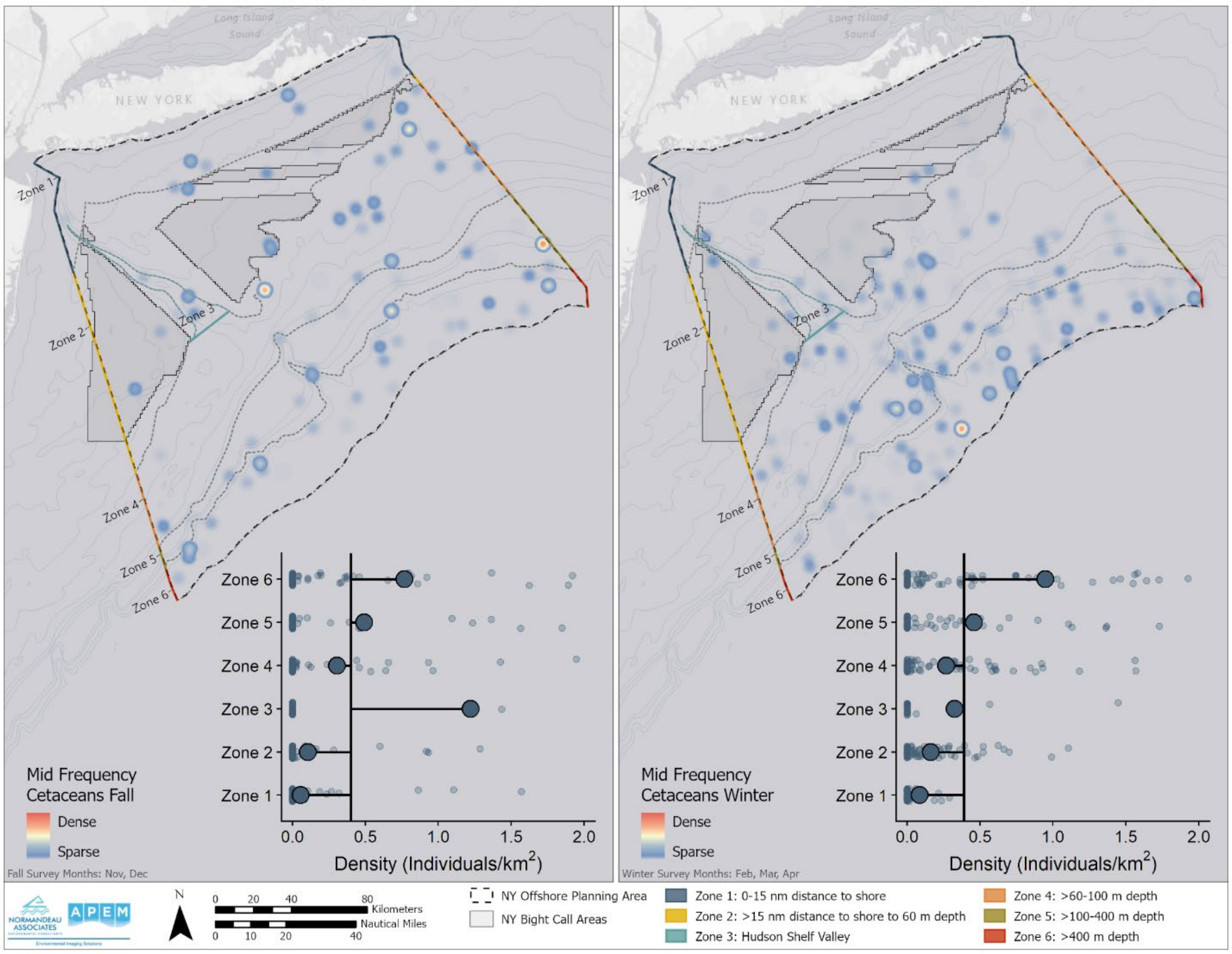


Figure 12. Heat Map Showing Spatial Distribution for Mid-Frequency Cetaceans during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



The low-frequency cetacean group includes common minke whale (n=30), as well as fin (n=43), sei (n=12), and humpback (n=20) whales. This group shows the same spatial patterns of distribution as NYSERDA (2017), although the temporal patterns of abundance differ; aerial digital data show greater abundance in Zone 6 in the summer rather than spring but match spatial and temporal patterns for Zone 5 (Figure 13, Figure 14).

Figure 13. Heat Map Showing Spatial Distribution for Low-Frequency Cetaceans during Spring and Summer by Zone and Location of the Current Identified Call Areas.

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

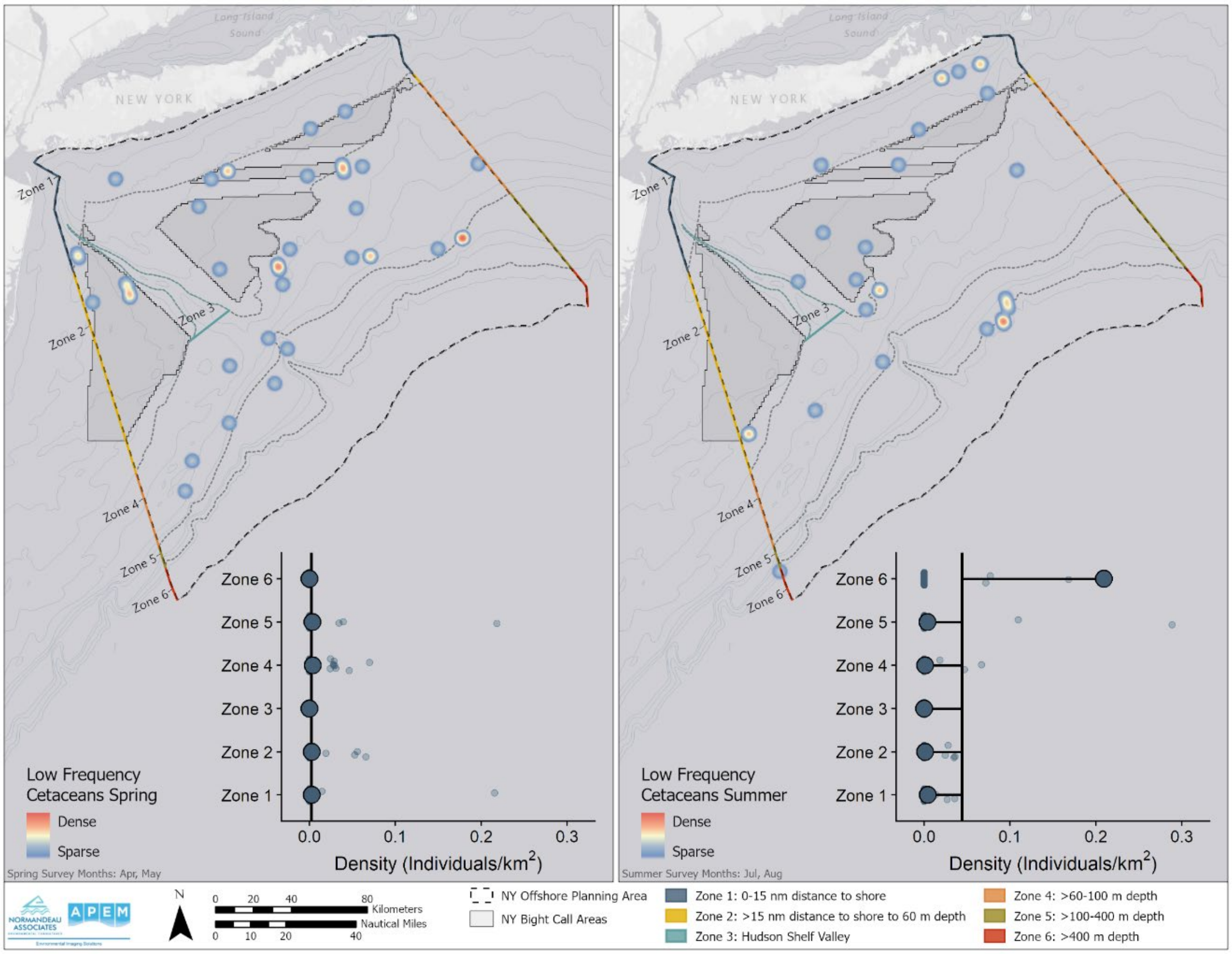
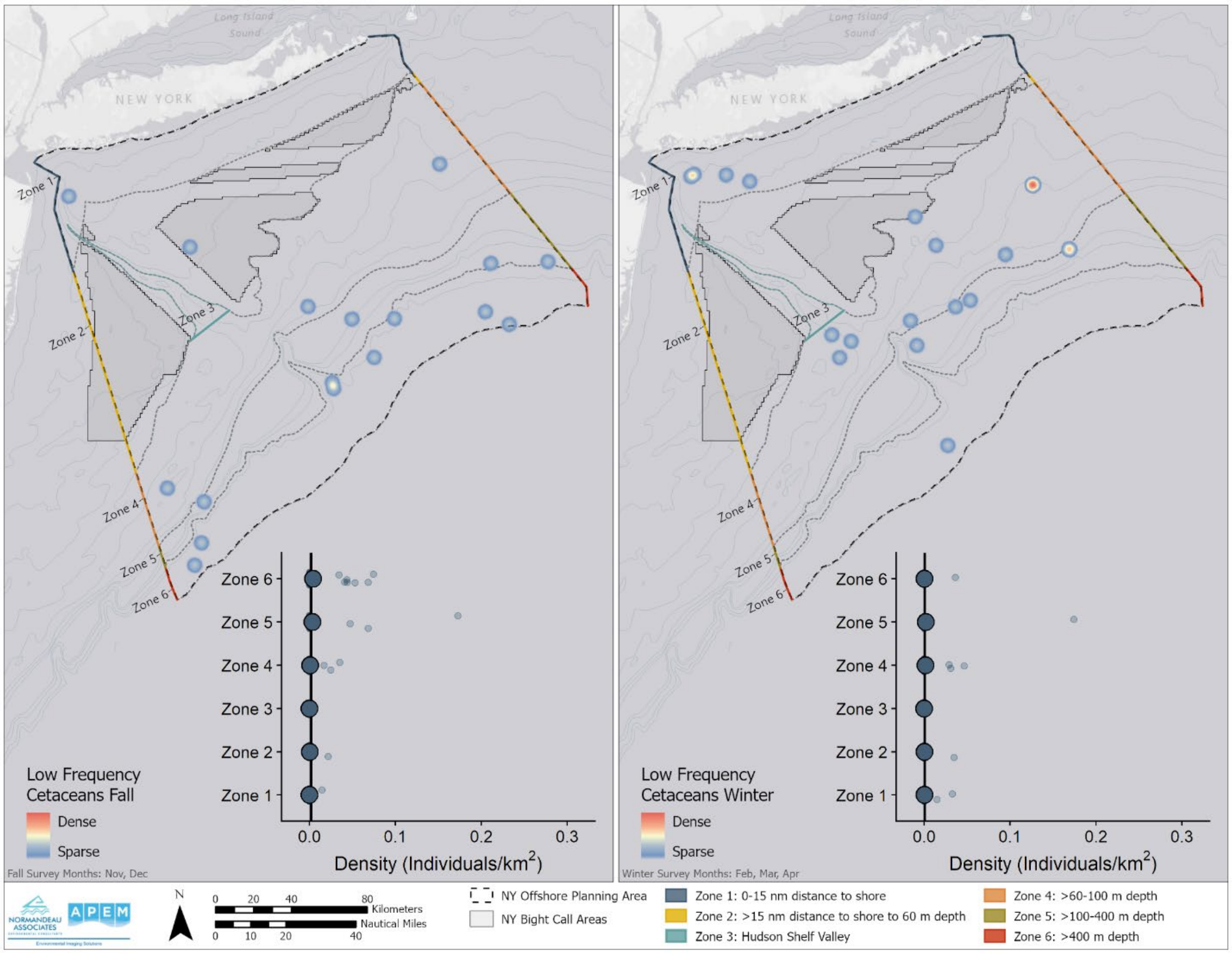


Figure 14. Heat Map showing Spatial Distribution for Low-Frequency Cetaceans during Fall and Winter by Zone and Location of the Current Identified Call Areas.

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



Seals show the same pattern of density and distribution as "Area for Consideration" (NYSERDA 2017) although the higher abundance in the southwest and lower abundance in the northwest found in "Area for Consideration" (NYSERDA 2017) is not evident in the aerial digital data (Figure 15, Figure 16).

Figure 15. Heat Map Showing Spatial Distribution for Seals during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

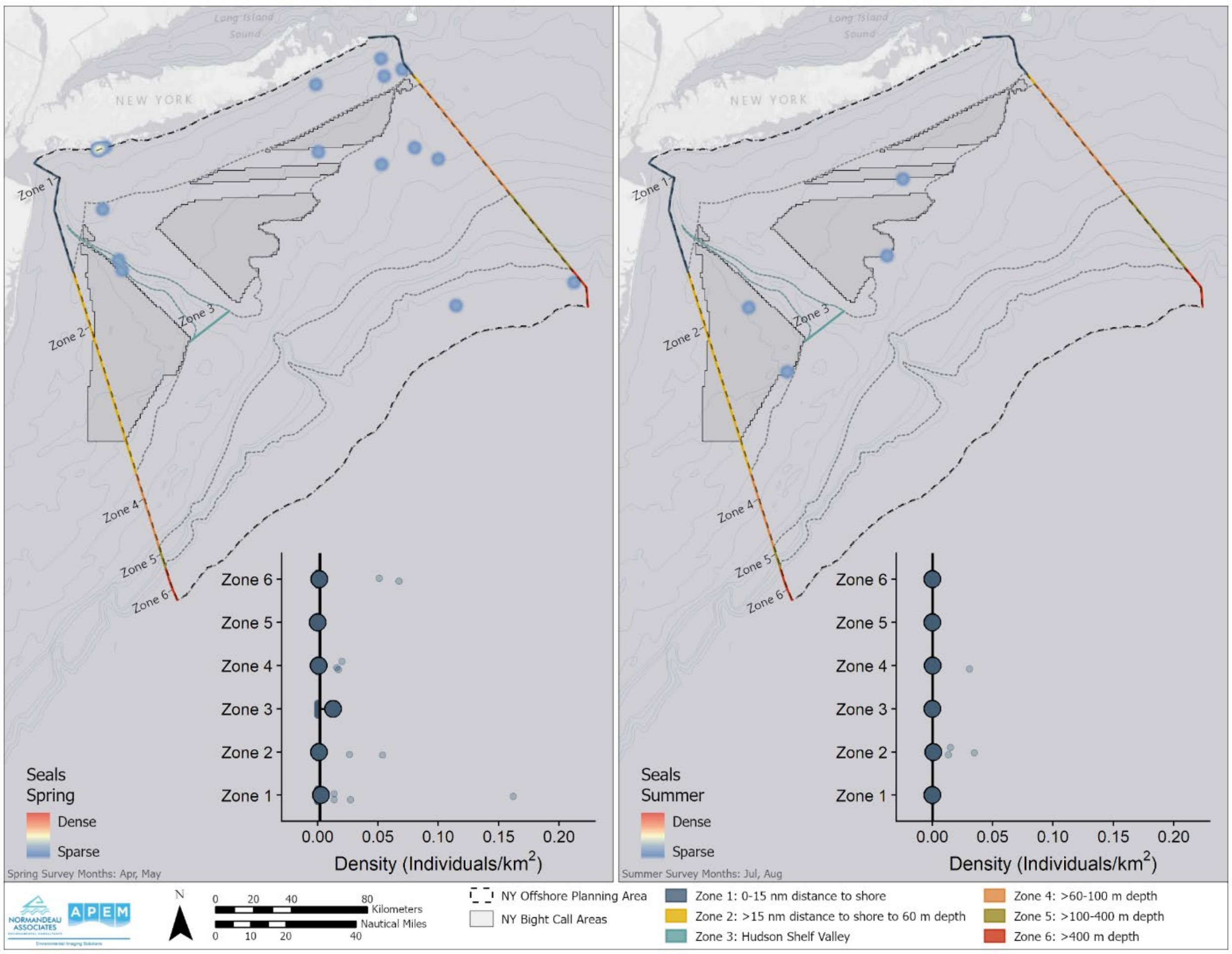


Figure 16. Heat Map Showing Spatial Distribution for Seals during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

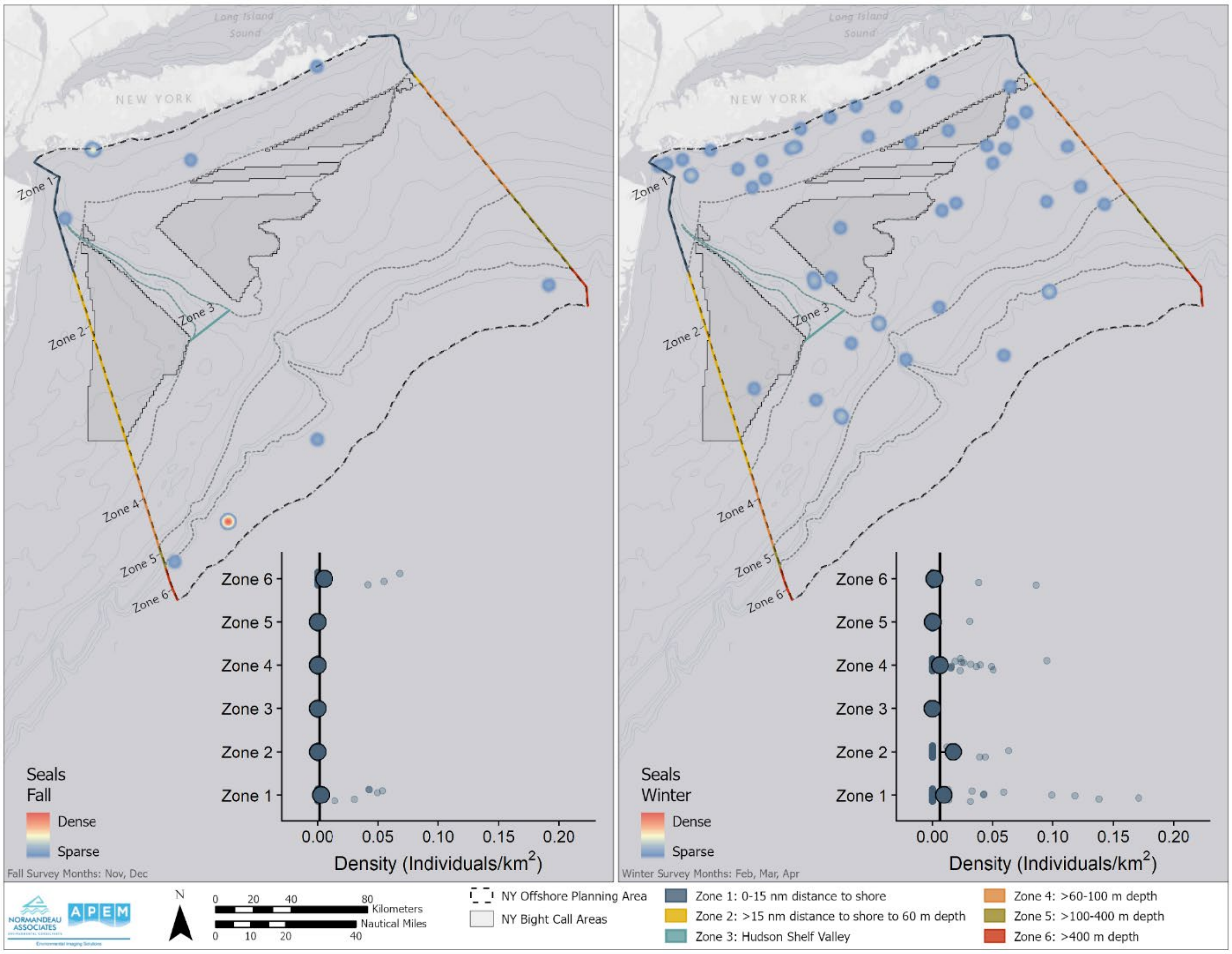


Table 3. Marine Mammals from Aerial Digital Surveys Represented in Each Auditory Frequency Group

High-Frequency Cetaceans	Mid-Frequency Cetaceans	Low-Frequency Cetaceans
Dwarf Sperm Whale	Sperm Whale	Blue Whale
Pygmy Sperm Whale	Beaked Whale (unid.)	Common Minke Whale
Harbor Porpoise	Common Dolphin	Fin Whale
	Short-finned Pilot Whale	Sei Whale
	Pilot Whale (unid.)	Humpback Whale
	Risso's Dolphin	
	Atlantic White-sided Dolphin	
	Rough-toothed dolphin	
	Atlantic Spotted Dolphin	
	Striped Dolphin	
	Bottlenose Dolphin	
	Common/White-sided Dolphin	

Note: Defined in NYSERDA (2017b)[1]

2.4 Rays

Most of the rays were cownose or bullnose rays (n=18,183). There was no analysis of rays in "Area for Consideration" (NYSERDA 2017) but the aerial digital data provide some insight into hotspots and temporal patterns of activity. The Area for Consideration Zone 2 shows the highest density of rays in the summer; most occurred to the east of Hudson Shelf Valley Zone 3. This area of high activity is outside the primary and secondary "draft Wind Energy Areas" that have been subsequently identified by the Bureau of Ocean Energy Management (BOEM) as the Hudson South Call Area within which most of this activity occurs (Figure 17, Figure 18).

[1] NYSERDA. 2017b. New York State Wind Master Plan Marine mammals and Sea Turtles Study. NYSERDA Report 17-25u. 164 p.

Figure 17. Heat Map Showing Spatial Distribution for Rays during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

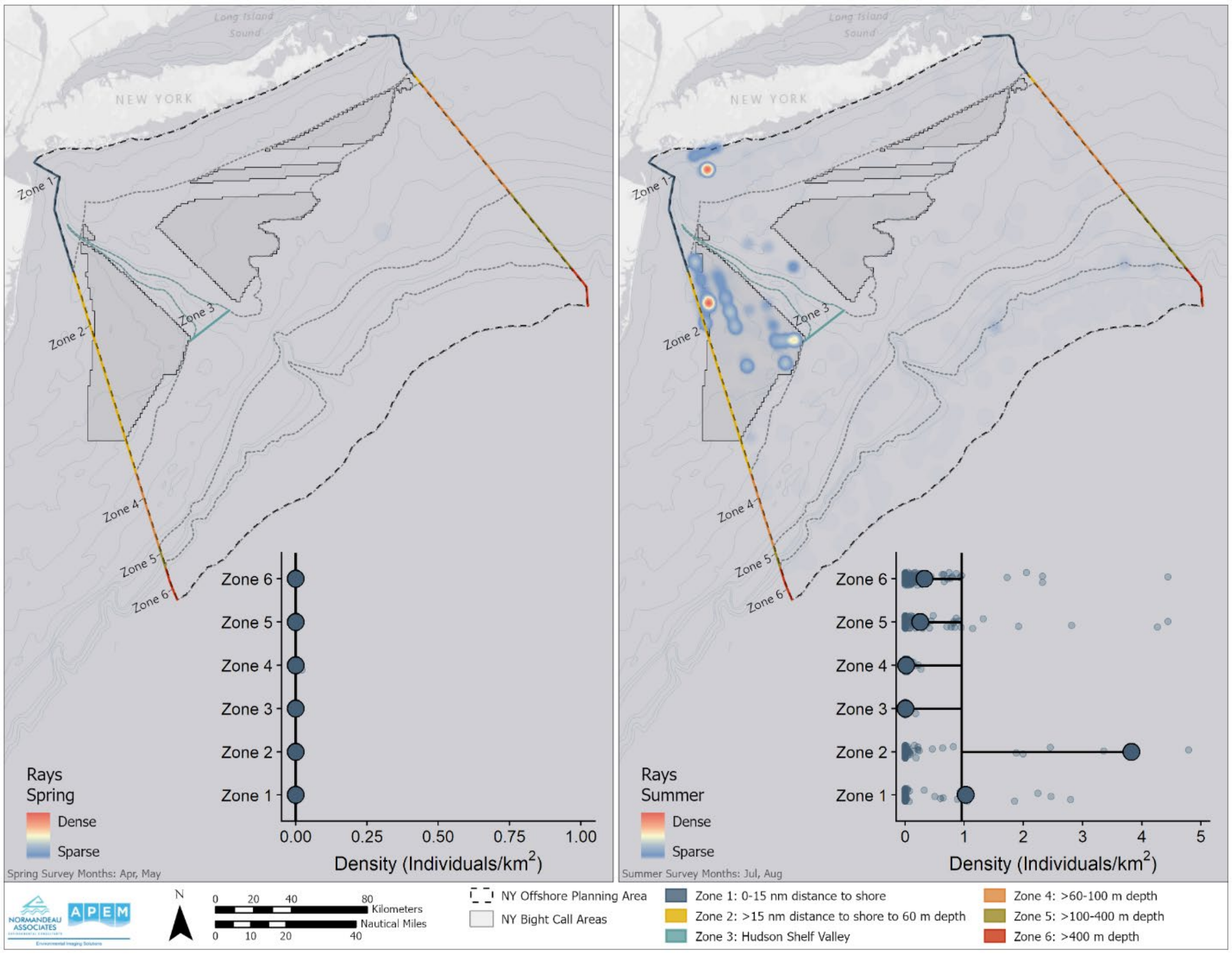
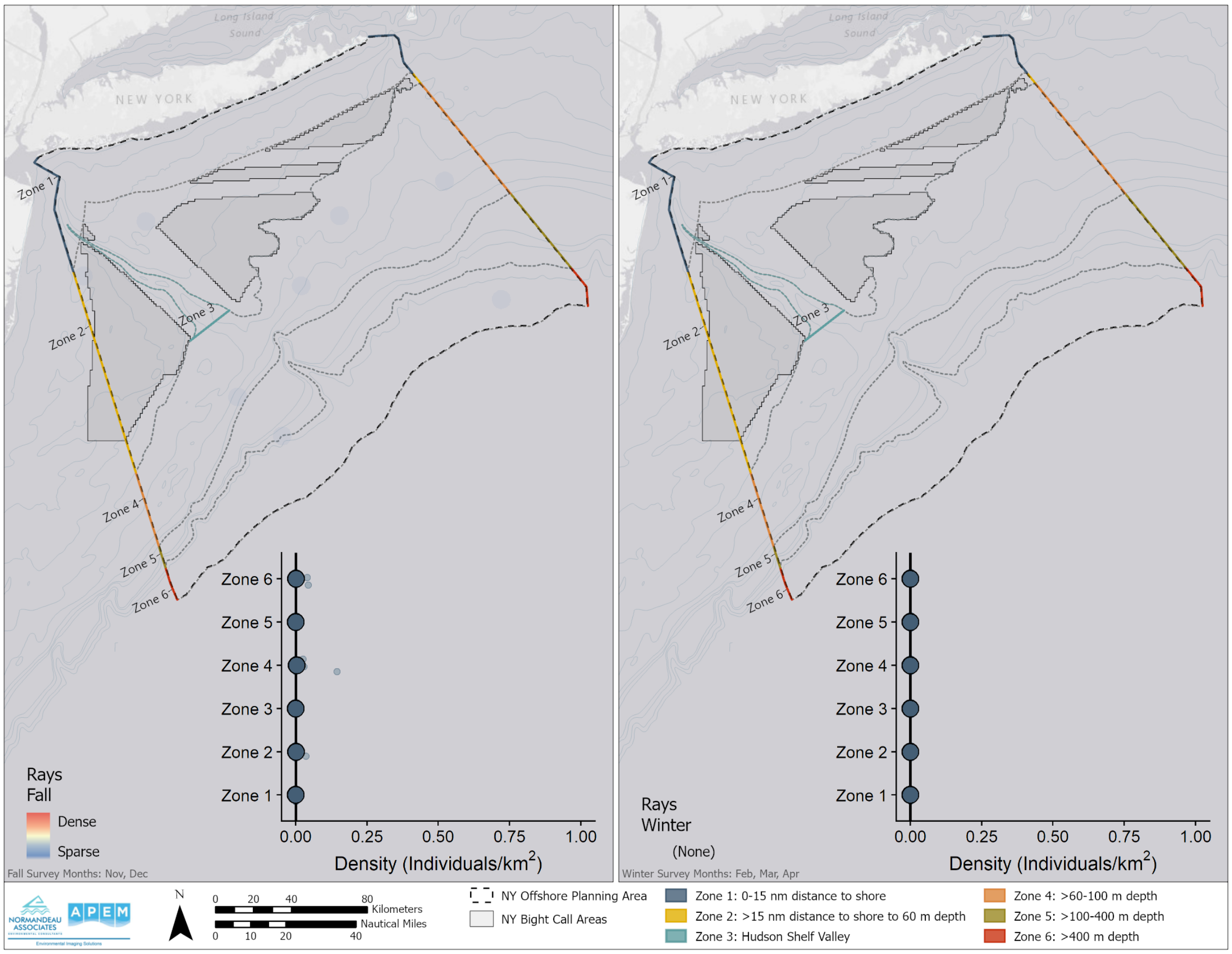


Figure 18. Heat Map Showing Spatial Distribution for Rays during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



2.5 Sharks

As with rays, sharks did not undergo any analysis in "Area for Consideration" (NYSERDA 2017) but aerial digital data provide some insight into patterns of activity in relation to the zones and identified call areas. Overall, densities were highest in the spring for all sharks except hammerhead sharks, and highest in Shelf Zone 4 at that time (Figure 19, Figure 20). Hammerhead sharks were observed more frequently in the summer when they were fairly evenly distributed across all zones. However, mean densities were always relatively low (Figure 21, Figure 22).

Figure 19. Heat Map Showing Spatial Distribution for Non-hammerhead Sharks during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

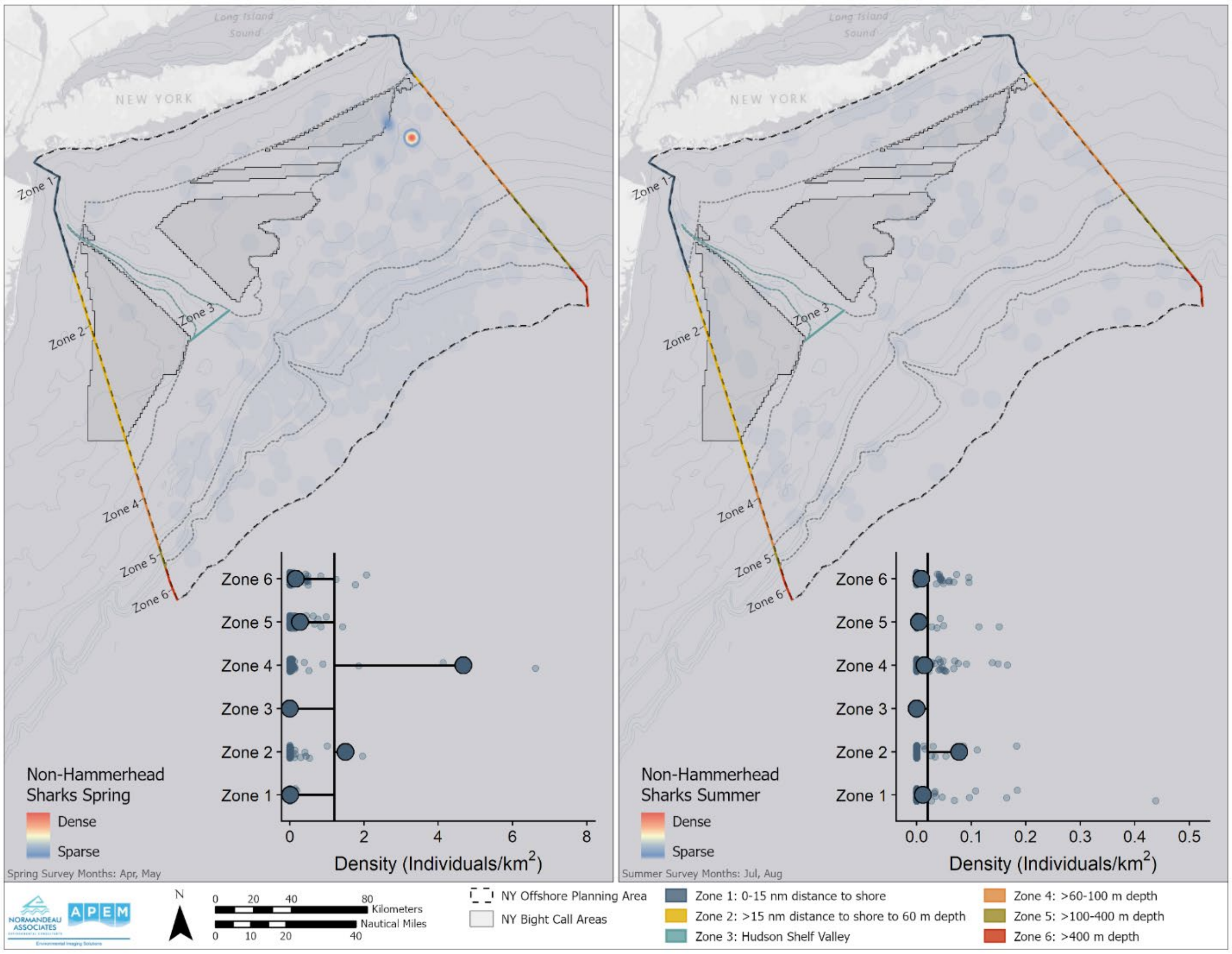


Figure 20. Heat Map Showing Spatial Distribution for Non-hammerhead Sharks during Fall and Winter by Zone and Location of the Current identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

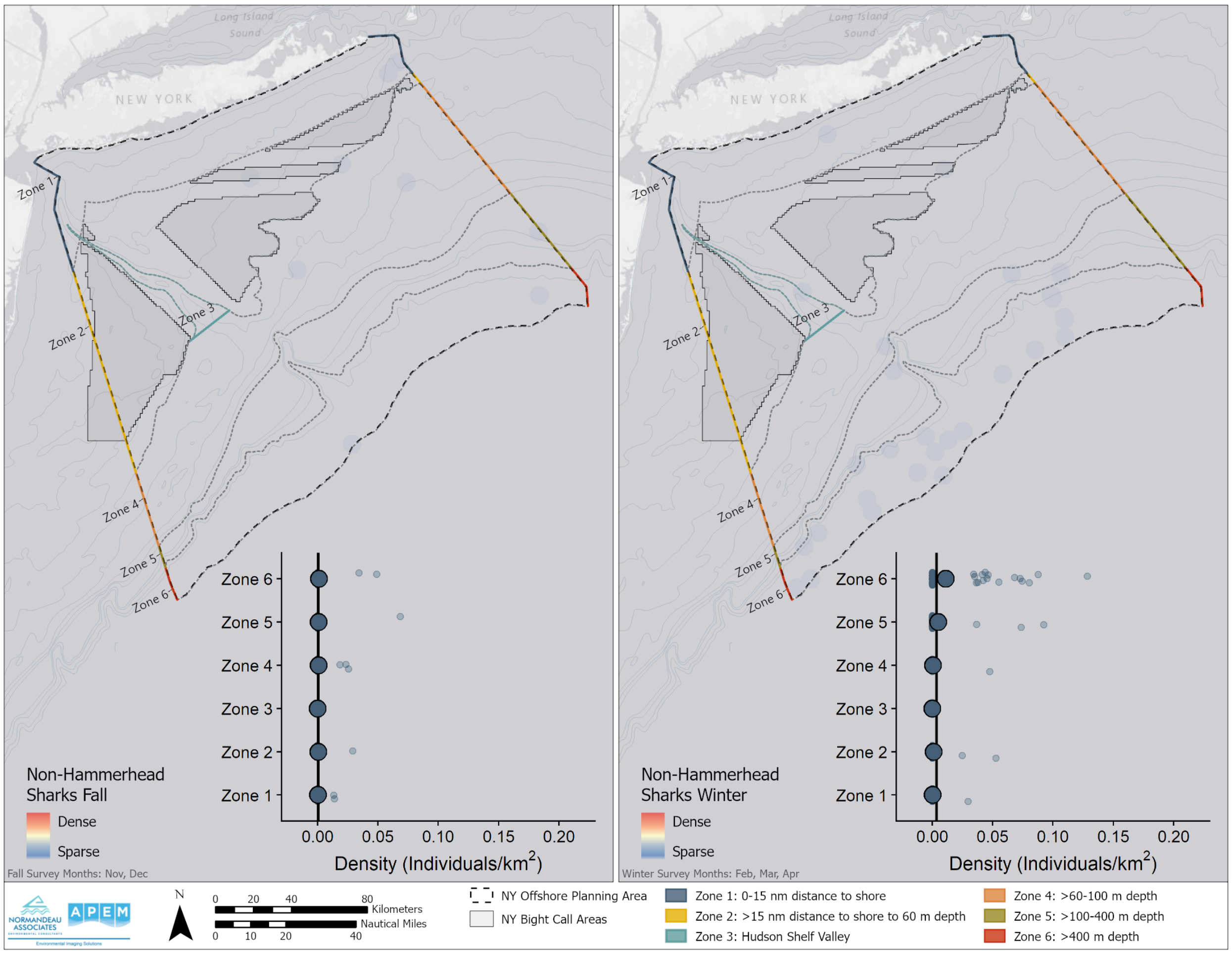


Figure 21. Heat Map Showing Spatial Distribution for Hammerhead Sharks during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

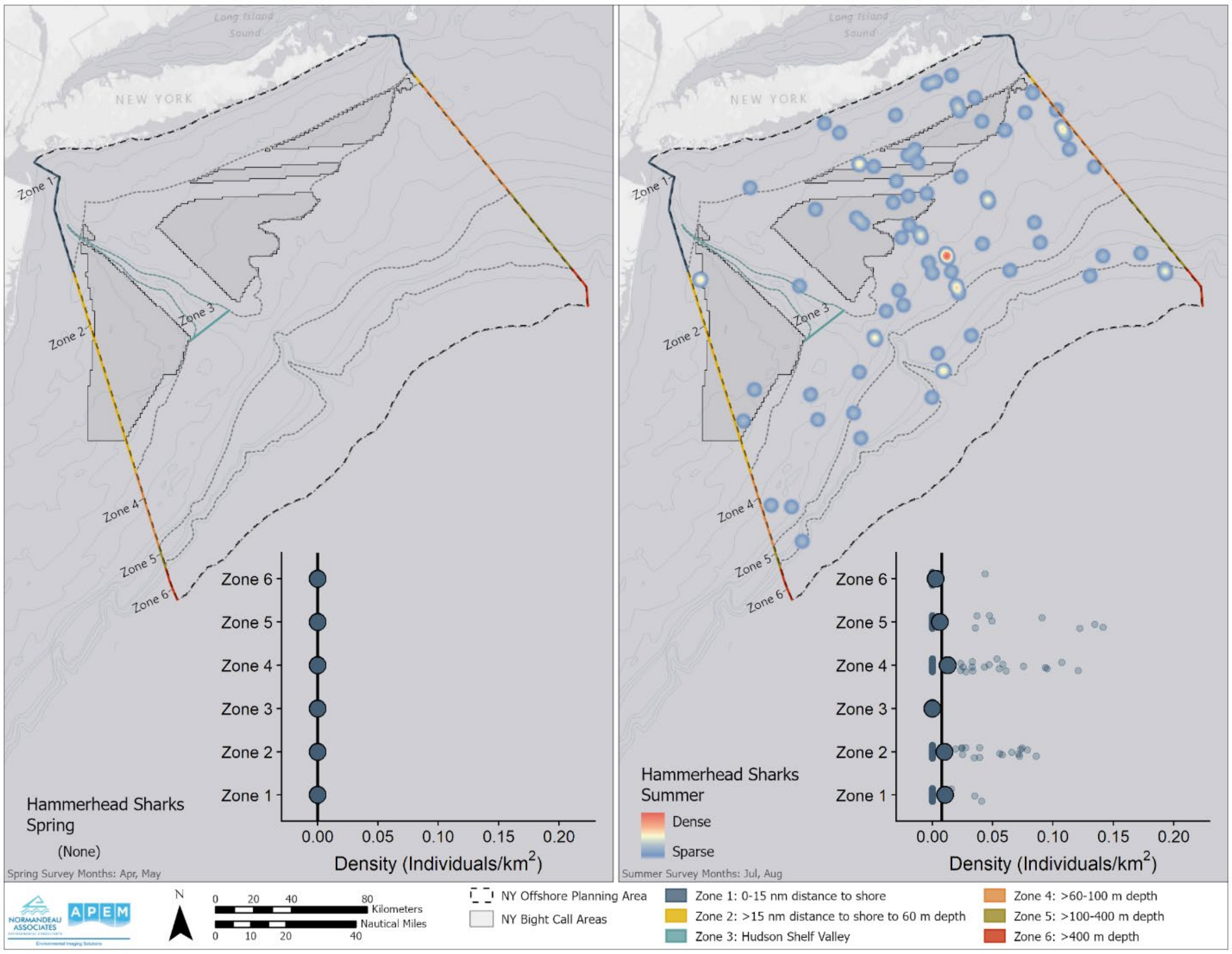
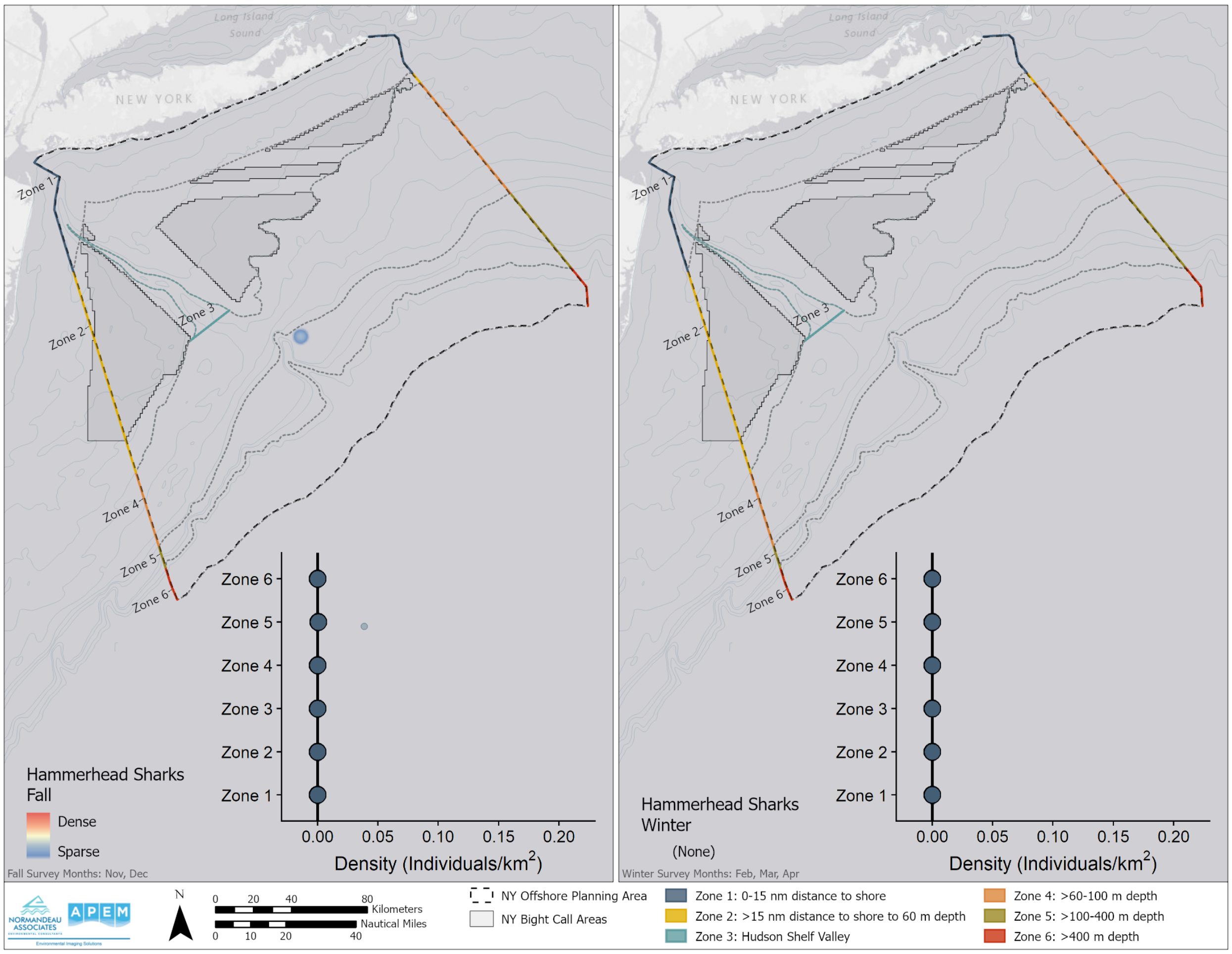


Figure 22. Heat Map Showing Spatial Distribution for Hammerhead Sharks during Fall and Winter by Zone and Location of the Current Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



2.6 Endangered Species

Unsurprisingly, endangered species were rarely encountered and none showed preference for Area for Consideration Zone 2. For those species with sufficient data points from aerial digital surveys, we provide heat maps. For even rarer species, we provide point maps showing recorded locations and seasons.

2.6.1 Birds

Roseate terns are listed under the Endangered Species Act (ESA), and at this time, black-capped petrel is under review for listing. Roseate terns were positively identified in spring and summer surveys and potentially show a slight preference for Shelf Slope Zone 5 in the spring (Figure 23). Similarly, black-capped petrels show no real preference for zone 5 but do regularly appear in Shelf Break Zone 6 (Figure 24, Figure 25). Piping plover are also listed under the ESA. None of these plovers were positively identified offshore, but one was encountered over a sandy coastal area in the summer 2018 survey (Figure 26).

Figure 23. Heat Map Showing Spatial Distribution for Roseate Terns during Spring and Summer by Zone and Location of the Current Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

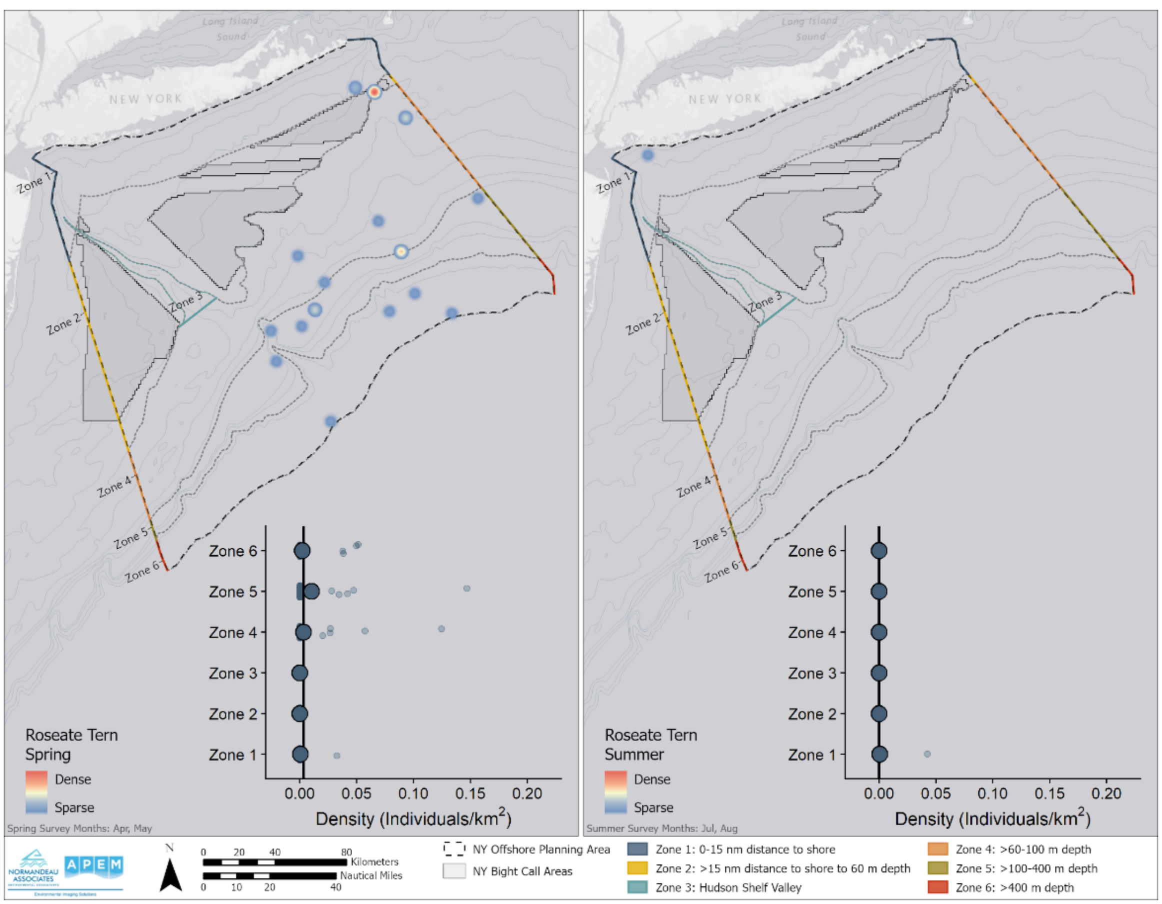


Figure 24. Heat Map Showing Spatial Distribution for Black-Capped Petrels during Spring and Summer by Zone and Location of the Current Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

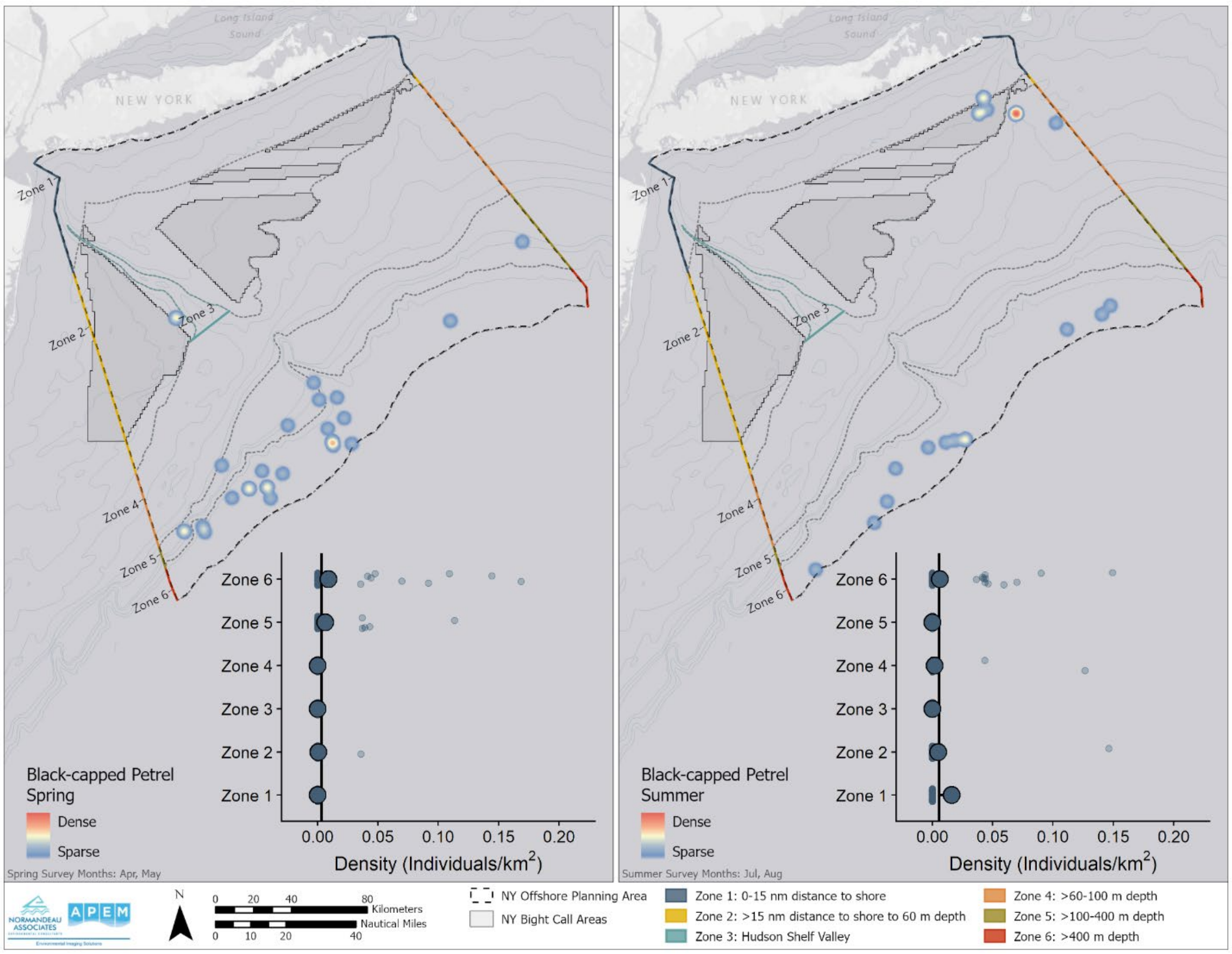


Figure 25. Heat Map Showing Spatial Distribution for Black-Capped Petrels during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

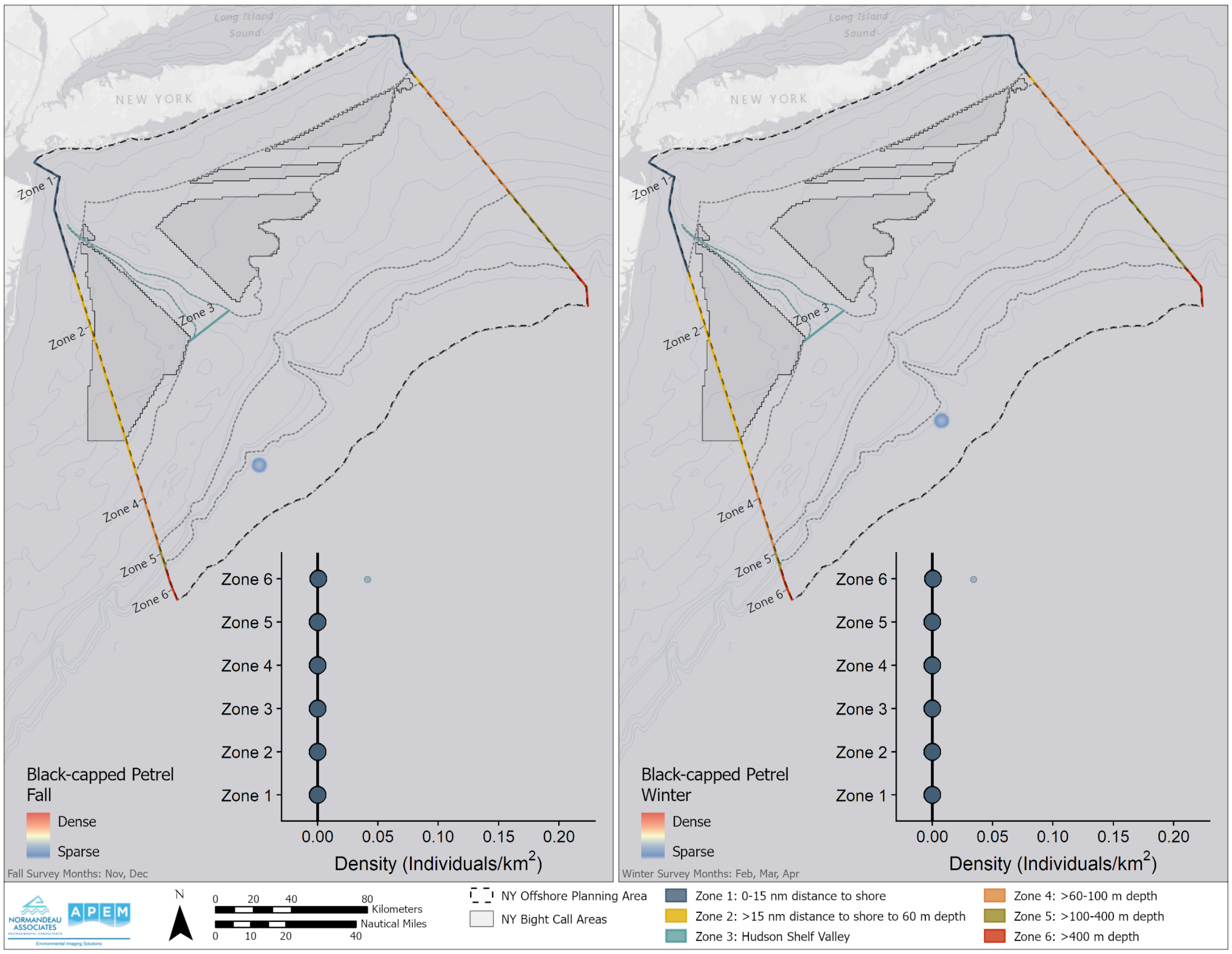
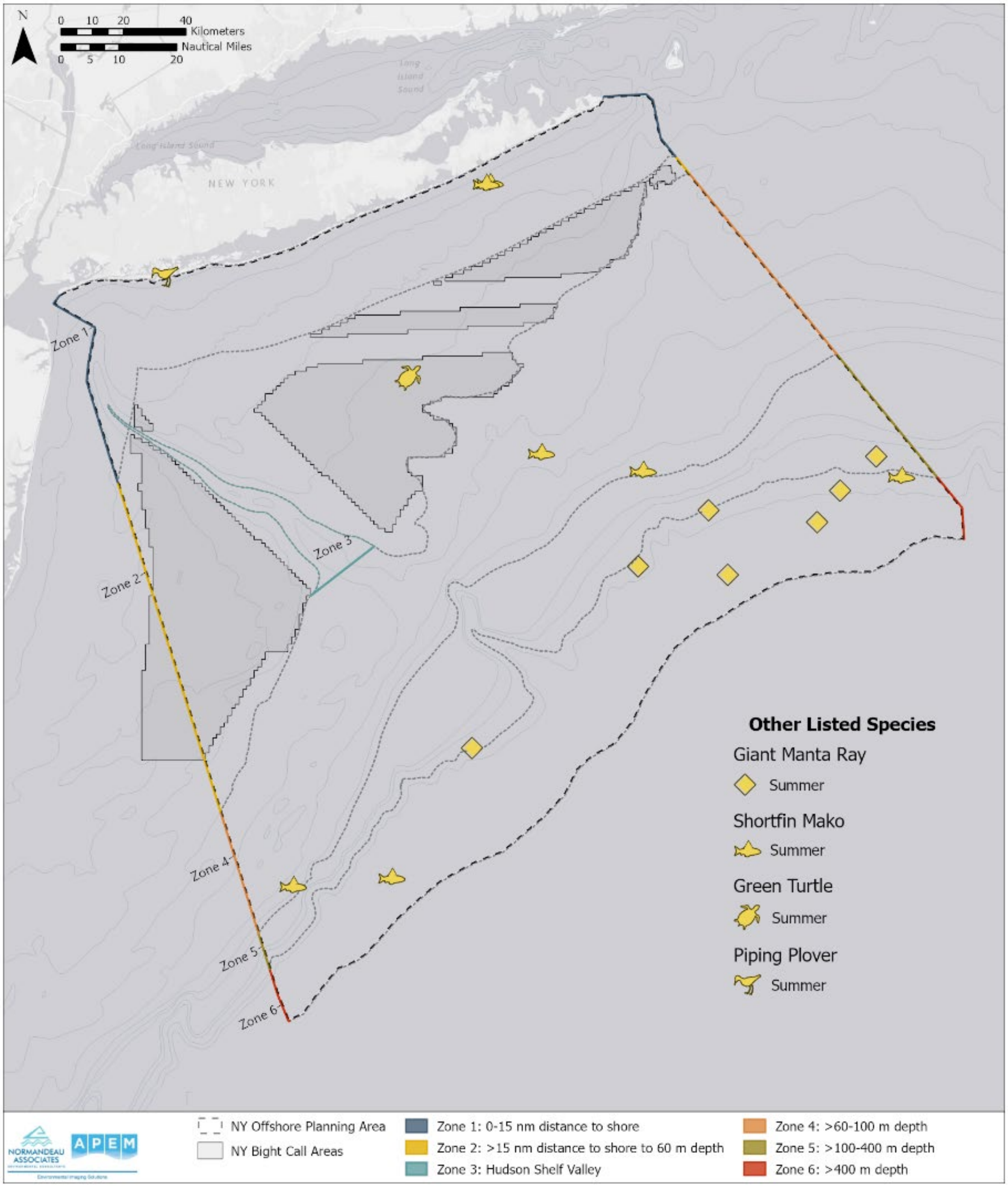


Figure 26. Spatial Distribution for Endangered Species with Low-Encounter Rates, by Zone, and Location of the Current Identified call Areas



2.6.2 Turtles

All turtles are listed under the Endangered Species Act, although in the OPA it is clear that densities of loggerhead turtles are higher than other species (Figure 27 through Figure 32). Leatherback densities are higher in the fall showing some preference for Coastal Zone 1 (Figure 27, Figure 28). Loggerhead turtle densities are highest in the summer and the turtles do show a preference for the Area for Consideration Zone 2 (Figure 29, Figure 30). Kemp's ridley turtles show a preference for Coastal Zone 1 in the summer, although there is some higher density in the western corner of Area for Consideration Zone 2 (Figure 31, Figure 32). There was only one green turtle positively identified in the summer 2016 survey and this was found within a proposed call area in Area for Consideration Zone 2 (Figure 26).

Figure 27. Heat Map Showing Spatial Distribution for Leatherback Turtles during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

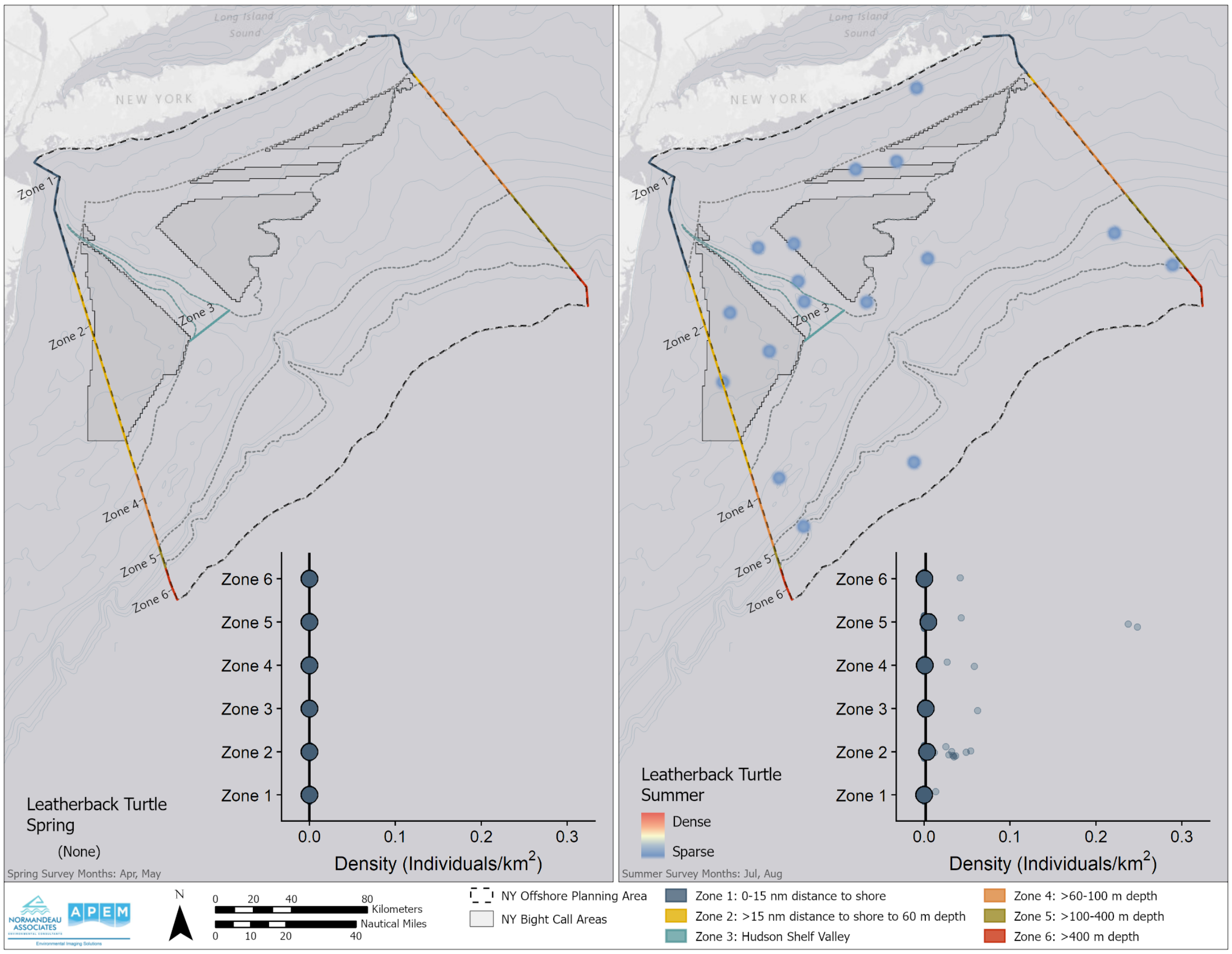


Figure 28. Heat Map Showing Spatial Distribution for Leatherback Turtles during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

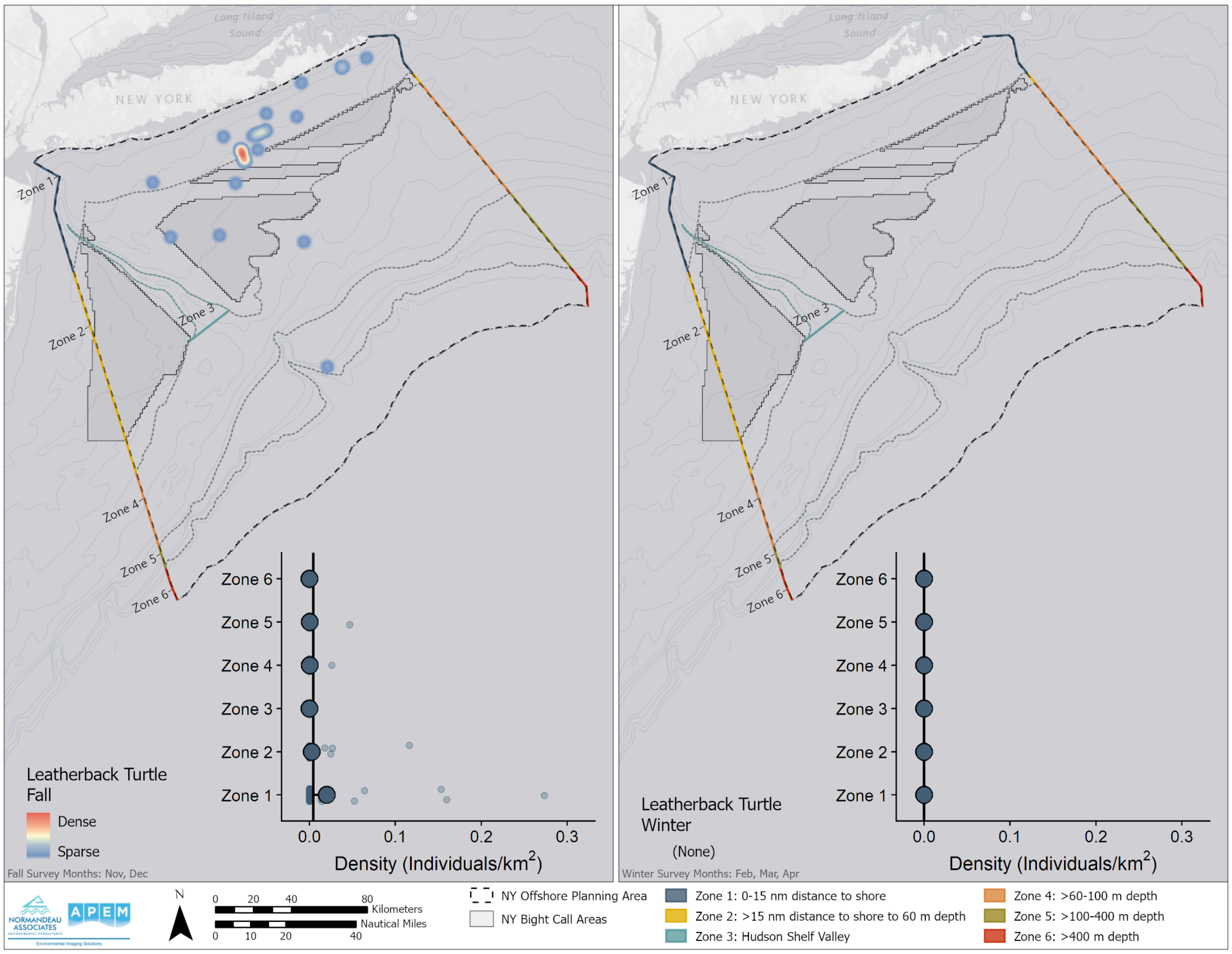


Figure 29. Heat Map Showing Spatial Distribution for Loggerhead Turtles during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

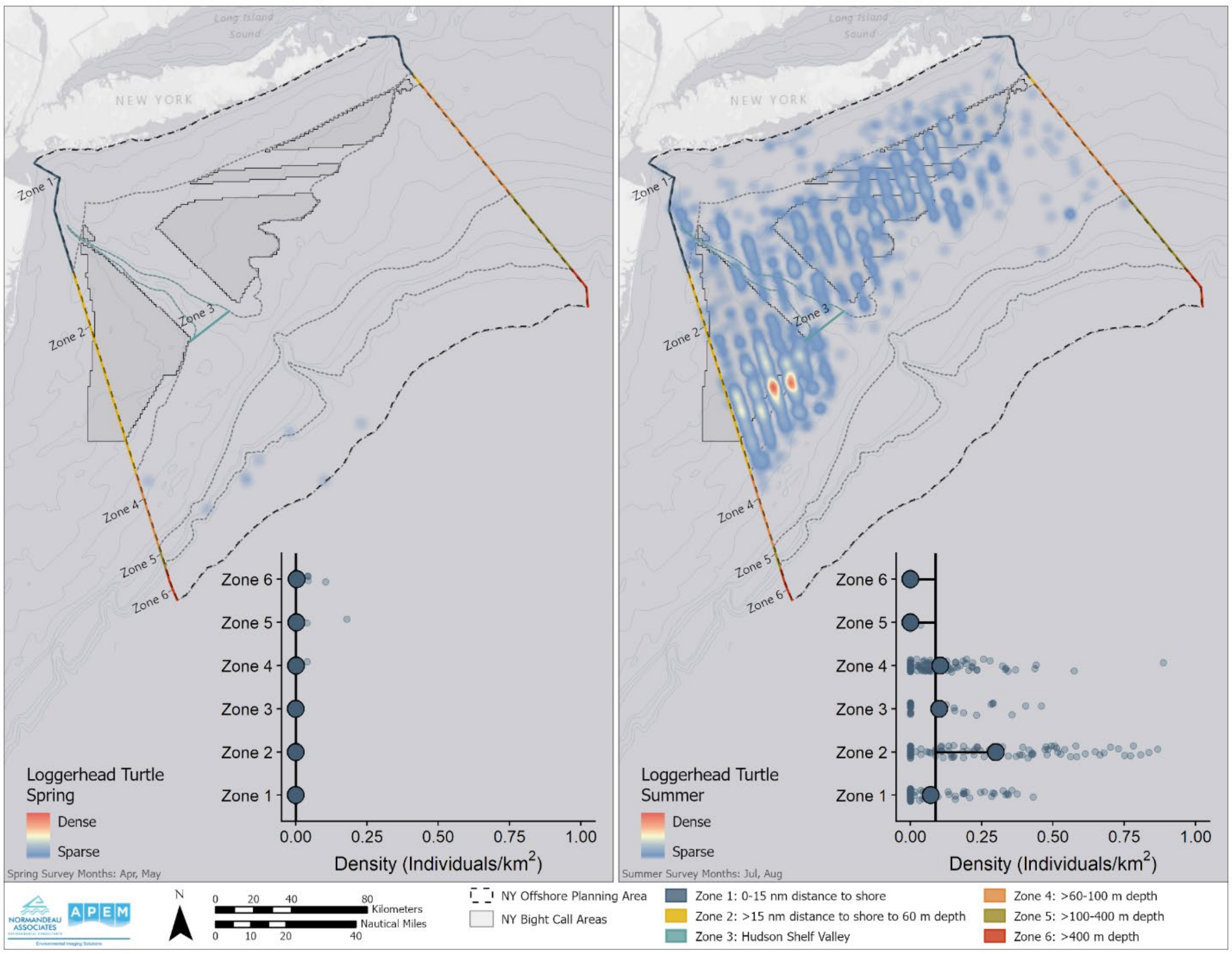


Figure 30. Heat Map Showing Spatial Distribution for Loggerhead Turtles during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

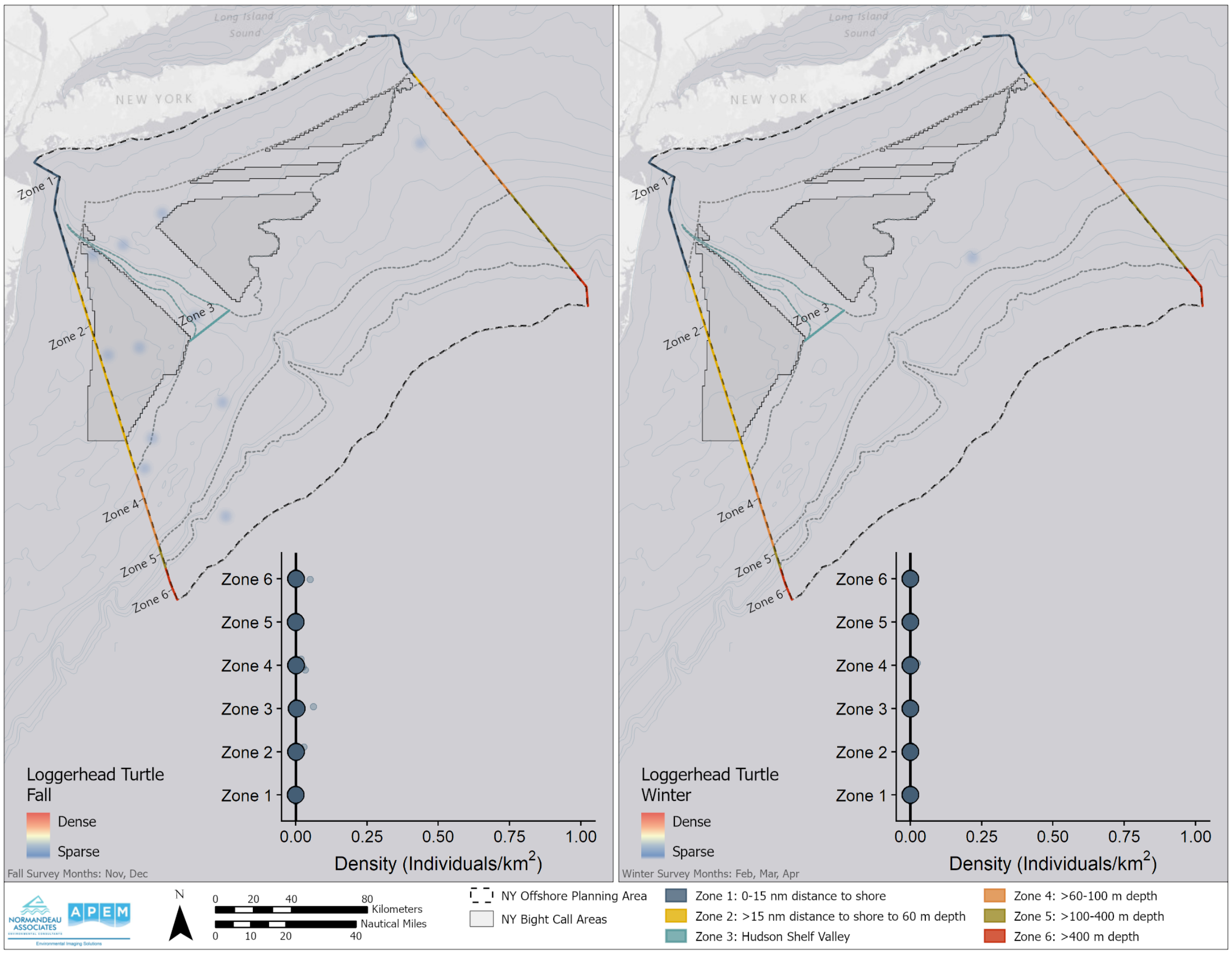


Figure 31. Heat Map Showing Spatial Distribution for Kemp's Ridley Turtles during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

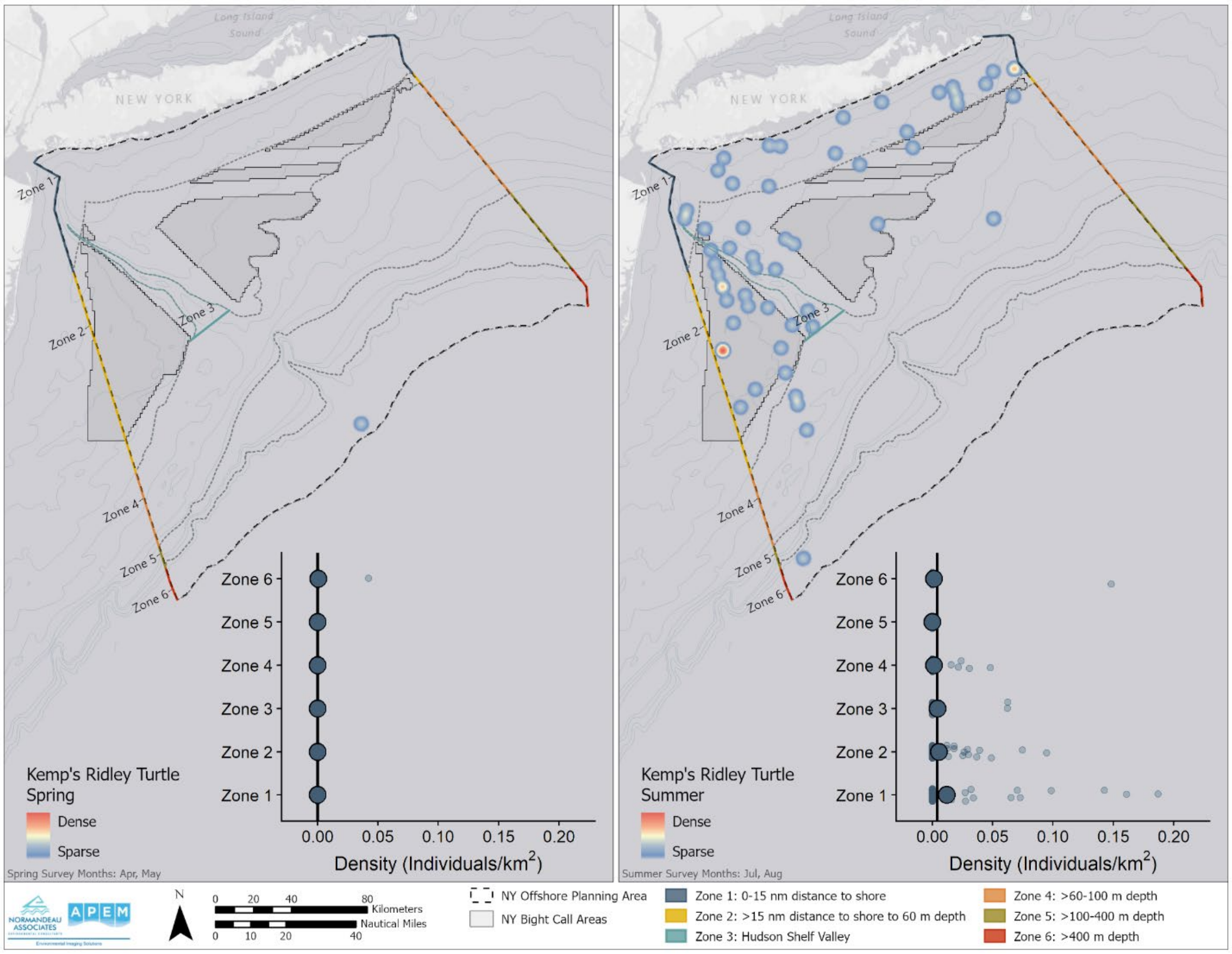
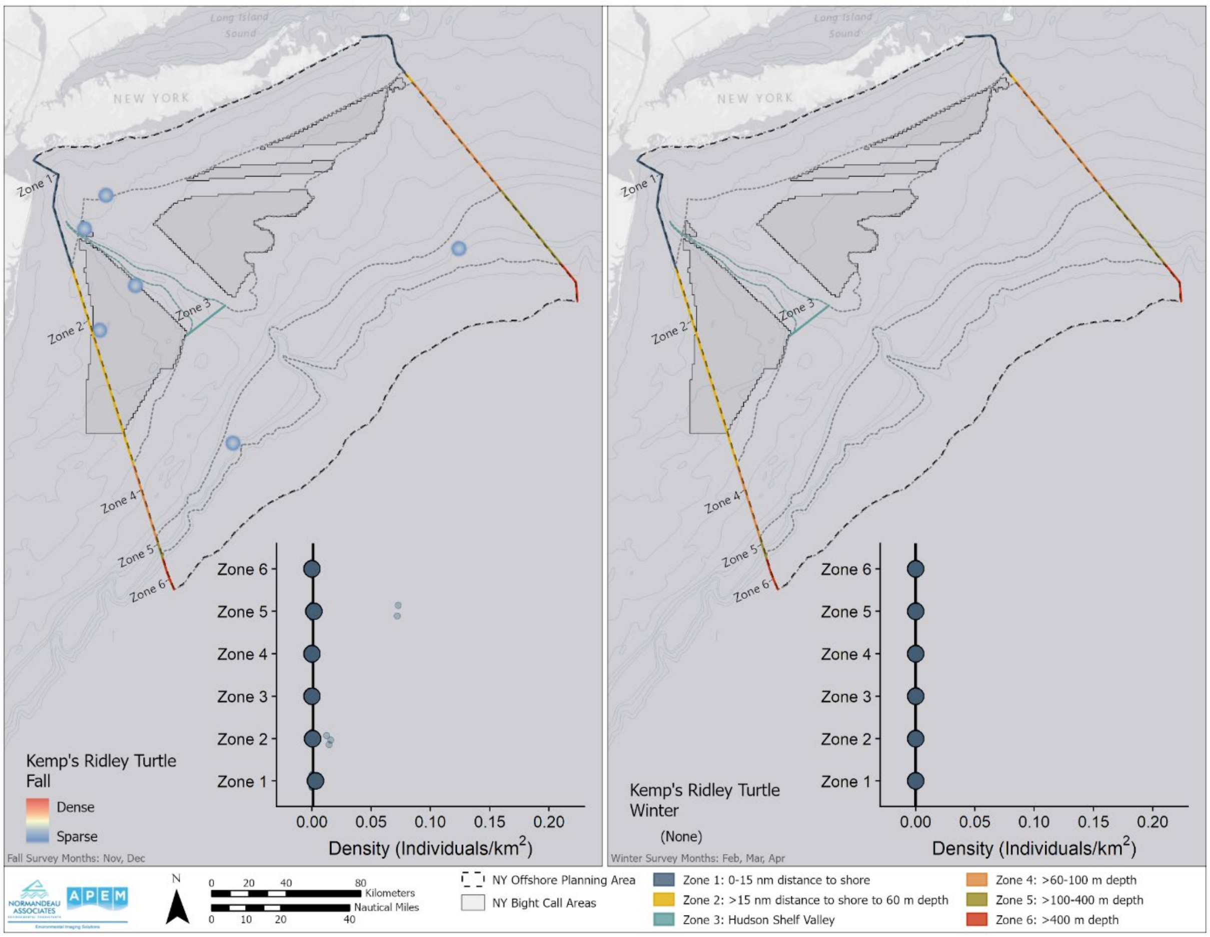


Figure 32. Heat Map Showing Spatial Distribution for Kemp's Ridley Turtles during Fall and Winter by Zone and Location of the Current Identified Call Areas

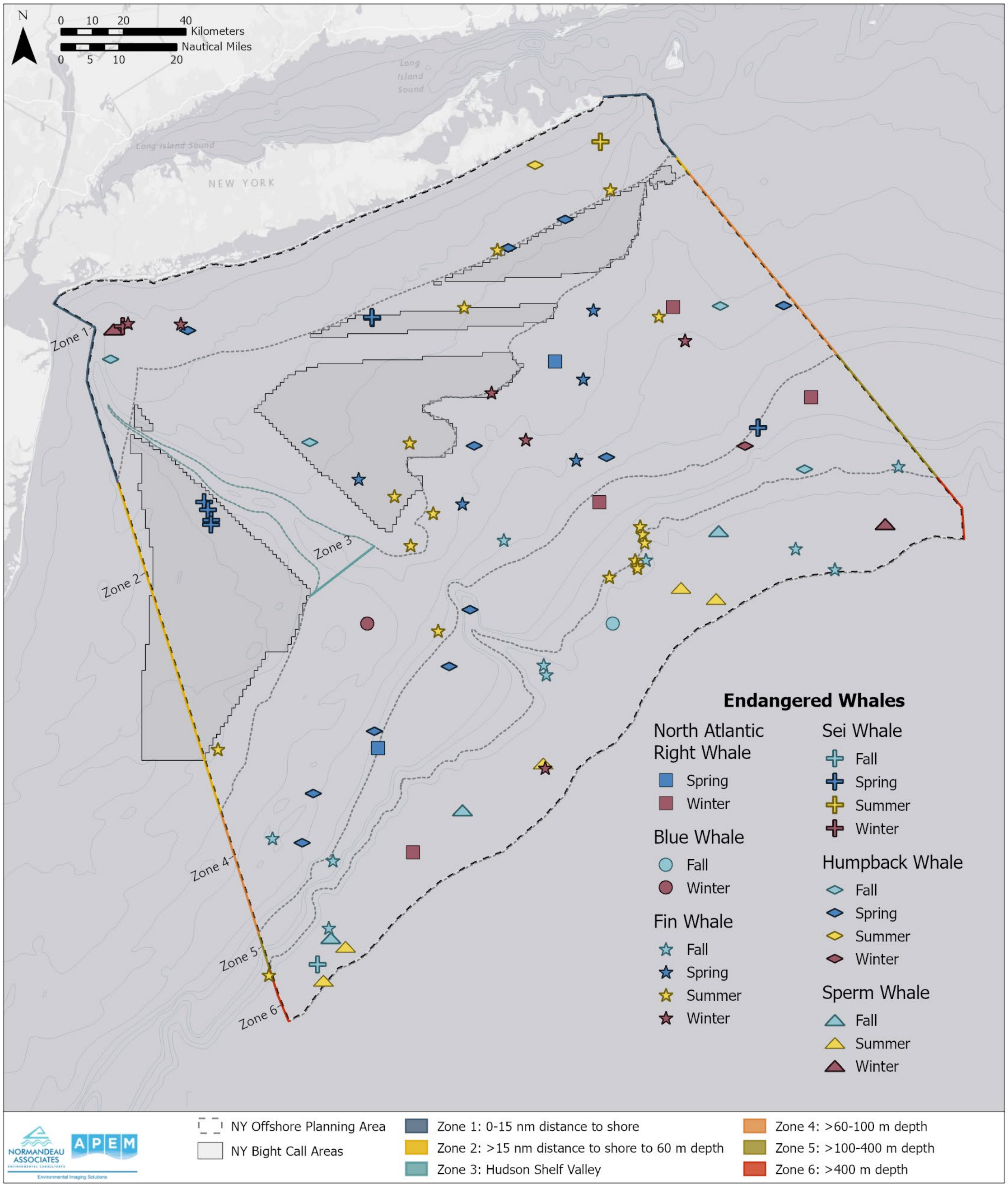
Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



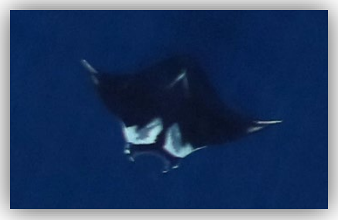
2.6.3 Marine Mammals

As discussed in "Area for Consideration" (NYSERDA 2017), all endangered whale species, including North Atlantic right whale, show the same overall low abundance throughout the whole OPA, and no detectable geographic preferences in part due to low-encounter rates (Figure 33).

Figure 33. Spatial Distribution for Federal and State Endangered Whale Species with Low-Encounter Rates by Zone and Location of the Current Identified Call Areas



2.6.4 Rays



These aerial digital surveys of the New York OPA were the first to positively identify giant manta rays at this most northerly latitude of their assumed range along coastal USA. Seven giant manta rays were found across all surveys, occurring only in the summer, and all occurring in the Shelf Break Zone 6 (Figure 26).

2.6.5 Sharks

Scalloped hammerhead and shortfin mako sharks are listed under the Endangered Species Act. Encounter rates of shortfin mako sharks were low (n= 7) and they showed no preference for any zone, although they were absent from Area for Consideration Zone 2 (Figure 26). Scalloped hammerhead sharks showed a slight preference for Shelf Slope Zone 5 (Figure 34, Figure 35).

Figure 34. Heat Map Showing Spatial Distribution for Scalloped Hammerhead Sharks during Spring and Summer by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.

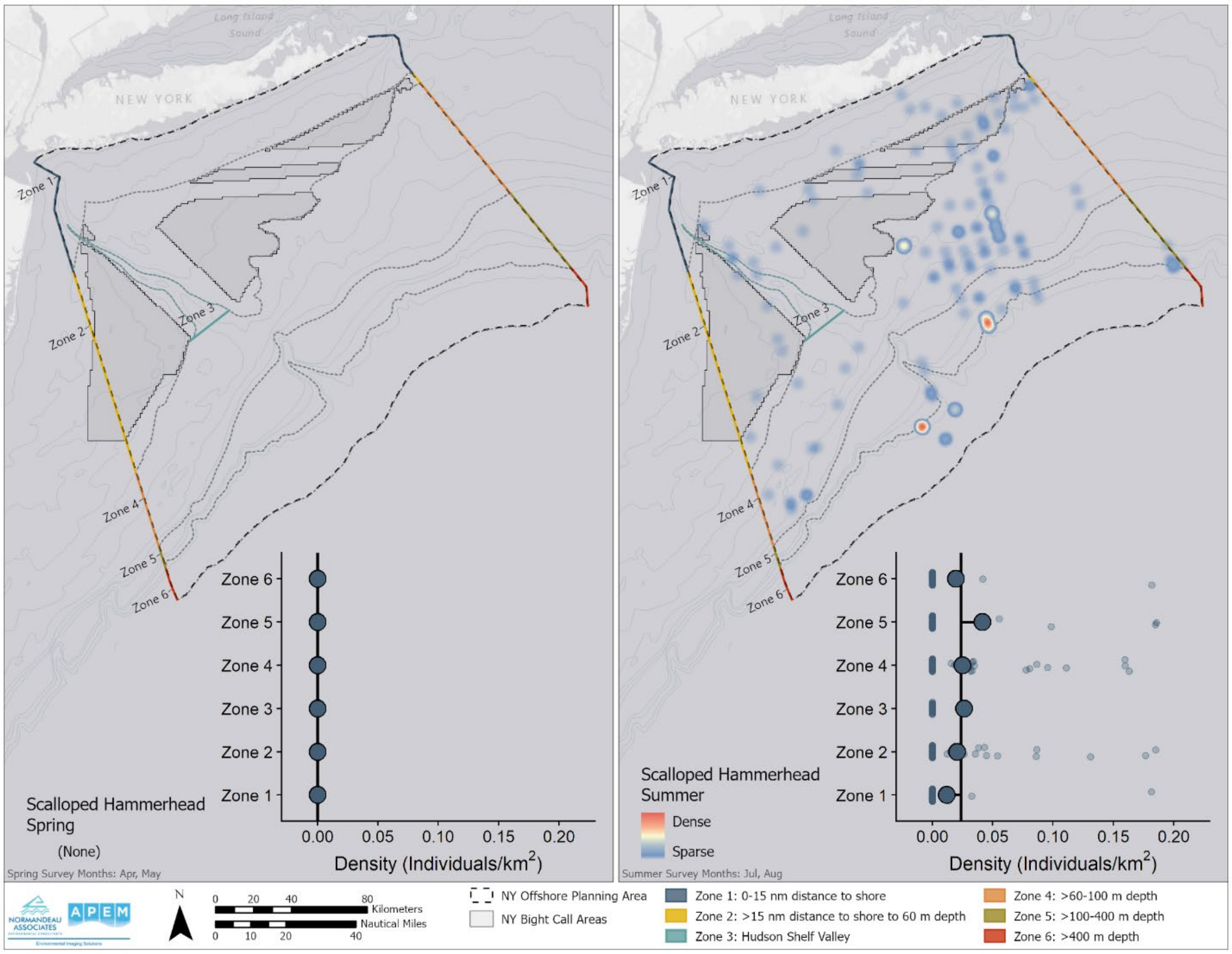
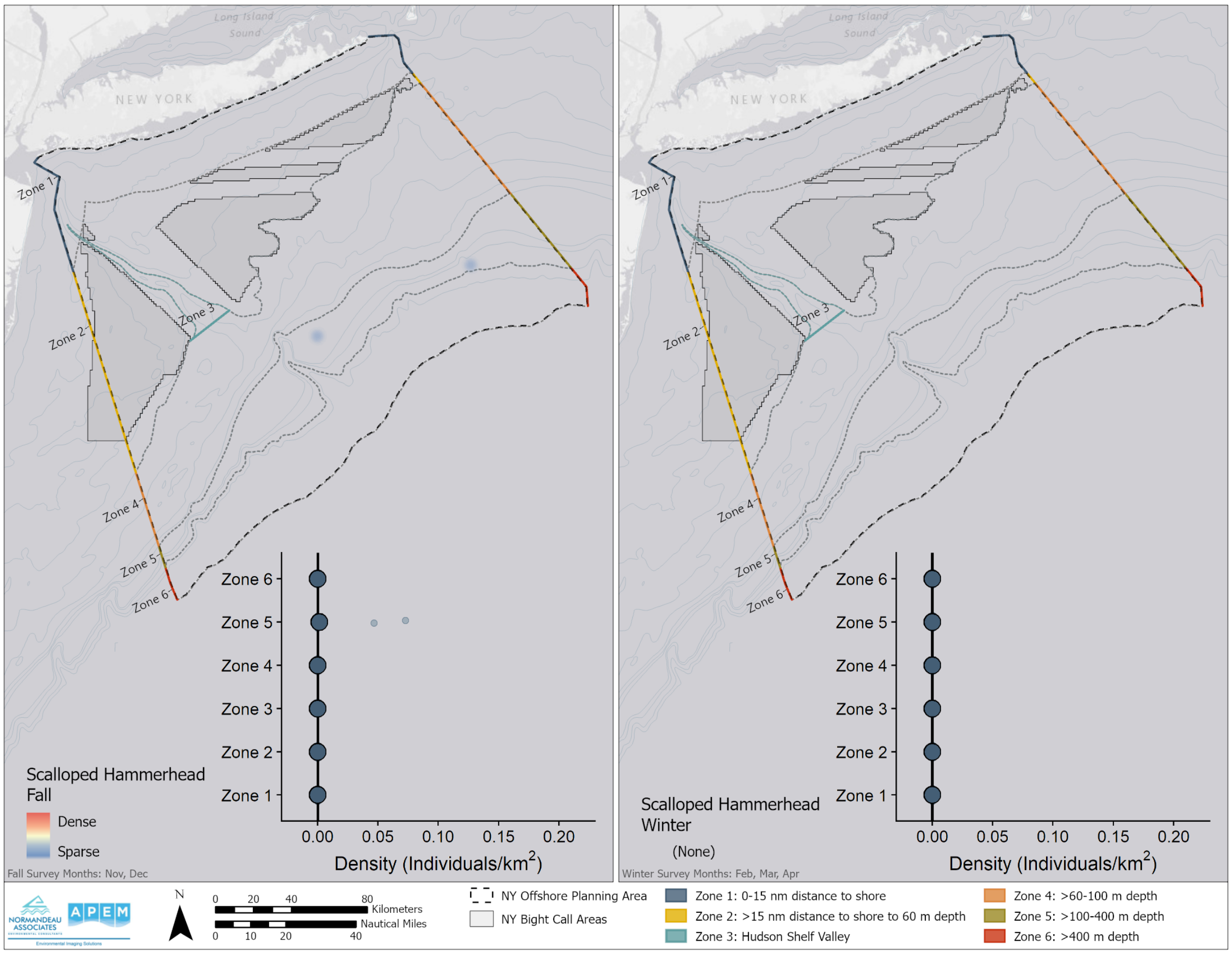


Figure 35. Heat Map Showing Spatial Distribution for Scalloped Hammerhead Sharks during Fall and Winter by Zone and Location of the Current Identified Call Areas

Heat map density maximum is scaled to the maximum density for the species/species group across all seasons. Inset figure shows estimated densities within each zone. Small points represent density estimates for each strip transect within each zone, and large points represent the mean density estimates within each zone. The vertical line represents the mean density estimate for the whole OPA across all zones.



3 Conclusion

Results from aerial high-resolution surveys can provide insight into spatial and temporal animal distributions within a surveyed area. Data from these surveys can inform wind turbine siting decisions at a high level at each site through better understanding of species composition, relative abundance, and animal movements. This information can also be used in developing project-specific environmental documents such as Environmental Assessments and Environmental Impact Statements should the need arise. Multiyear surveys over large areas such as the New York OPA allow insight into interannual variation in patterns of density and distribution of animals visible from the air.

Data collected during these surveys confirm that the proposed call areas for wind energy identified in "Area for Consideration" (NYSERDA 2017) are in areas with lower abundances of marine and avian resources.

4 References

NYSERDA. 2017. New York State Area for Consideration for the Potential Locating of Offshore Wind Energy Areas. NYSERDA Report 17-25u. 144 p.

NYSERDA. 2017b. New York State Wind Master Plan Marine mammals and Sea Turtles Study. NYSERDA Report 17-25u. 164 p.

Robinson Willmott, J. C., G. Forcey, and A. Kent. 2013. The Relative Vulnerability of Migratory Bird Species to Offshore Wind Energy Projects on the Atlantic Outer Continental Shelf: An Assessment Method and Database. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2013.

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